DOCUMENT RESUME

ED 028 617 EF 002 878

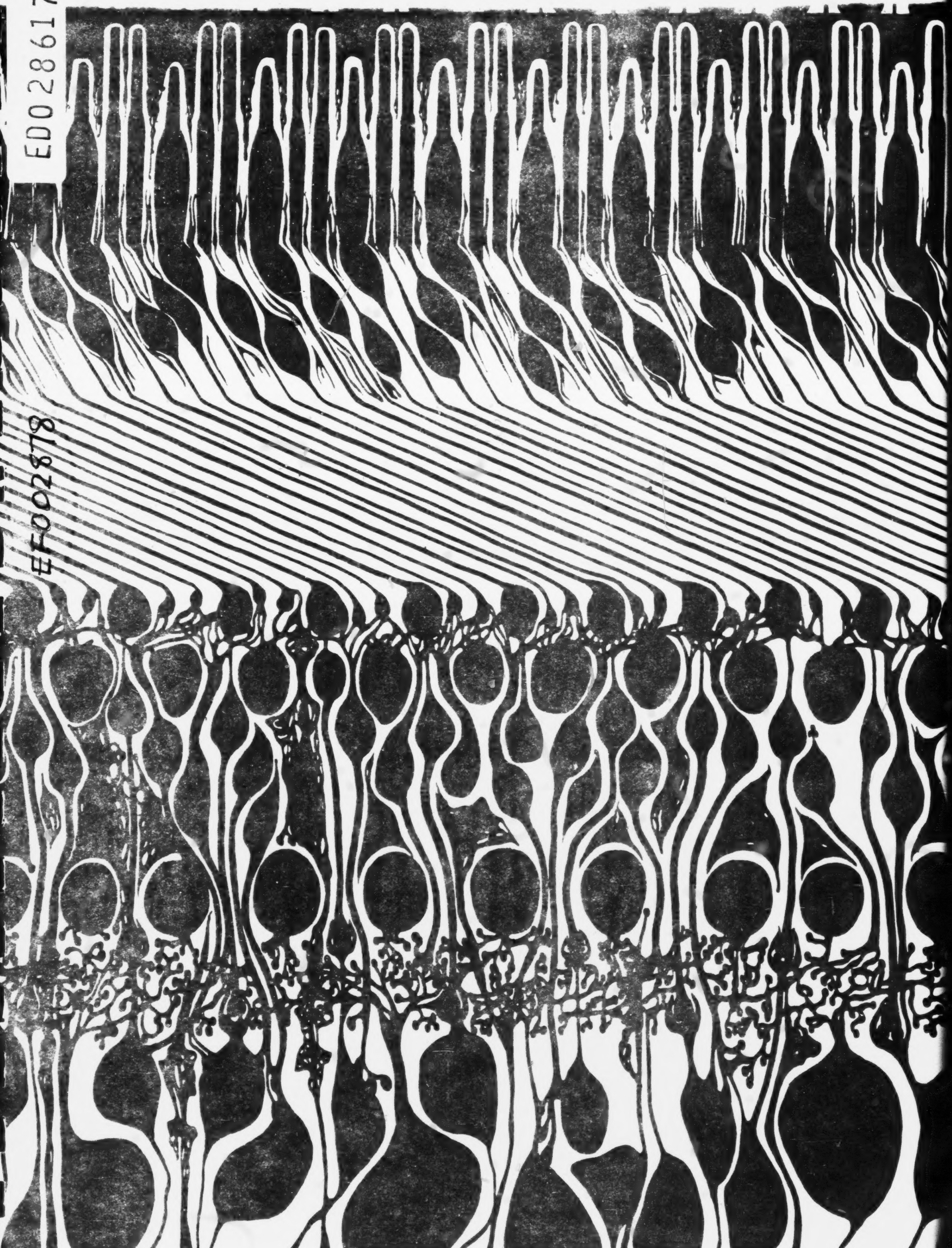
Educational Facilities for the Visually Handicapped.

California Univ., Berkeley. Dept. of Architecture.
Pub Date 66
Note-217p.; The result of a nine month study of eighteen third year students in the Department of Architecture, University of California, Berkeley.
EDRS Price MF-$1.00 HC-$10.95
Descriptors-Architecture, Design Needs, Discipline, *Educational Facilities, *Educational Specifications, Equipment, *Facility Requirements, Individual Needs, Mobility, Multiply Handicapped, Perception, Social Environment, *Space Orientation, Student Attitudes, Therapeutic Environment, *Visually Handicapped

The material presented is not the total of all the effort expended during the year, but is instead, a brief description of the work process, and the results of the study by eighteen third year students in the Department of Architecture, University of California, Berkeley. The introduction states the problem, the process, and the organizational procedure. The other sections are as follows--(1) research phase, (2) requirements, (3) interactions, (4) decomposition and structuring, (5) form solutions and diagramming, (6) final form solutions, and (7) summary. The architectural form and organization can affect the blind child greatly by helping or hindering his ability to move about with ease and affecting his sense of orientation. The degree and nature of separation of groups and of individual blind children play an important part in effective teaching and therapy. Information in these areas and many others has been accumulated, digested and synthesized into a valid, abstract, architectural reflection of the factors needed to develop the multiply handicapped blind child to his fullest mental and physical potential. (RK)

ED028617

EF002878



the cover: a schematic section of the human retina. actual tissue thickness: 0.1 millimeter

ED028617

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

educational facilities for the visually handicapped

EF002878

CLASS MEMBERS

Dan Brewer
Ed Classen
Ed Conners
Stephen Dane
Peter Drake
Beth Falor
Ted Goldberg
Ray Gundlach
Fred Karren
Zvi Katz
Dennis McElroy
Michael O'Brien
Stephen Philips
Kit Ratcliff
Betty Seltzer
Brain Talcott
Michael Weinberger
Jack Williamson

Murray Silverstein, reader

Don Koenig, instructor

A CLASS STUDY PROJECT: architecture 101 -- section 5

architecture 102 -- section 2

UNIVERSITY OF CALIFORNIA

BERKELEY, CALIFORNIA

fall, 1965 -- spring, 1966

TABLE OF CONTENTS

Preface i

Introduction
- Part I: The Problem 1
- Part II: The Process 6
- Part III: The Organizational Procedure 8

Research Phase 11

Requirements 21

Interactions 33

Decomposition and Structuring 37

Form Solutions and Diagramming 39

Final Form Solution 45

Summary 49

Appendix A: Requirements and Interactions 51

Appendix B: Decomposition and Structuring 61

Appendix C: Form Solutions for Subsystems and Combinations 75

Bibliography

PREFACE

The following material is the result of a nine-month study by eighteen third-year students in the Department of Architecture at the University of California. This study was conducted as a group project within the framework of two consecutive five-unit architectural design courses. The material presented is not the total of all the effort expended during the year, but is, instead, a brief description of the work process and the results of the study.

It should be noted that this was the first time that these students had been introduced to the process employed in the study and that this introduction and familiarization with the process was the primary objective of the course. Consequently, whenever under pressure of time, a choice had to be made between the quality of the educational experience and the quality of the solution, the emphasis had to be placed on the former.

There are several people who were extremely helpful during the course of the study. In particular, we wish to thank Mr. Everett Wilcox, Superintendent, Mr. Philip Hatlen, Principal, and the staff and students of the California School for the Blind for their interest, encouragement and cooperation. By offering their time for interviews and allowing us the free use of their facilities for observation, they helped make the study very meaningful.

D. M. KOENIG

INTRODUCTION

INTRODUCTION

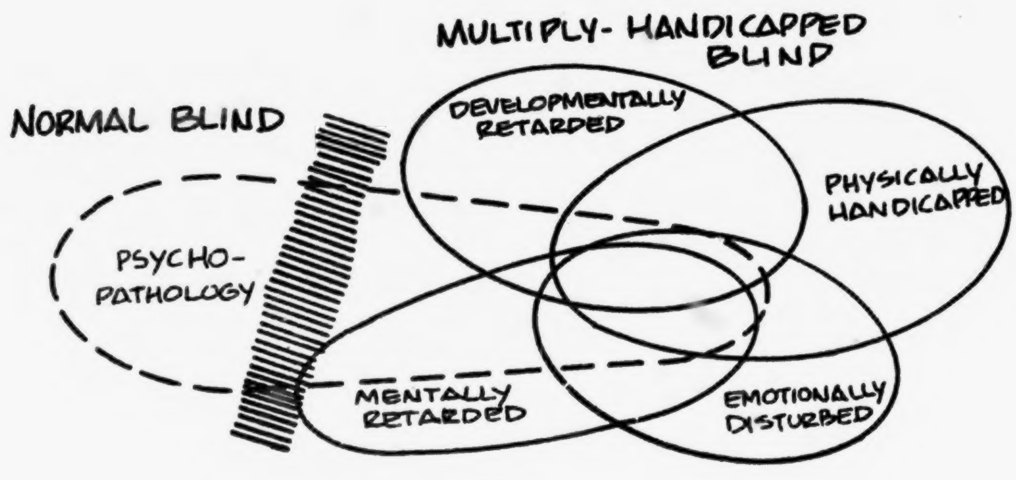
Part I: The Problem

Although the state of California numbers among its population approximately 3,129 blind and multiply-handicapped blind children of school age, it provides neither adequate facilities nor adequate trained personnel for their education. Treatment of children who, despite their several handicaps, have a chance of leading at least a semi-productive and independent life in a sighted society, is often either neglected entirely or is rendered ineffective by lack of adequate teachers and equipment. Children who have no handicap other than blindness (about 60%) are generally educated in public schools with special resource facilities to accommodate them. Prima facie, these schools do an adequate job and offer the "normal" blind children the advantage of daily contact with sighted peers. Blind children with multiple handicaps so severe that they have no chance of attaining any degree of independence are either cared for at state and private institutions or at home. As of December, 1965, in the state of California, there were approximately 3,129 blind children of school age. The following location breakdown occurs among these children:

1842	in public schools
781	in state and private mental institutions
170	in California School for the Blind
158	in unstated location
146	at home
32	on preadmission to hospitals or awaiting diagnosis

Of these children, it is the approximately 5% who attend the California School for the Blind who interest us most. These are the children who, although multiply-handicapped, are not without hope of attaining some degree of productivity and independence. There are others, kept at home or in unknown locations, who may also fit into this category. Although this number is small compared to that of "normal" blind and severely handicapped blind, it represents a largely passed-over and potentially rewarding field of study and work.

In establishing our problem boundary of concern with multiply-handicapped blind children, it was necessary to consider the educational needs of several different groups of blind children. The diagram below indicates the relationships among these groups:



Since these groups present too wide a variety of educational problems to be undertaken in a study of this nature and duration, we found it necessary to place limitations on our efforts. Criteria used in establishing our problem boundaries were: urgency of the problem; information available; information obtainable; coherence of the problem area; remaining class time.

The proposed alternatives were:

A. To include "normal" blind who are presently functioning adequately in a sighted educational environment.
   Reasons in support:
   1. Recreation: the greatest difficulty for the successful integration of blind children into a sighted educational environment seems to lie in their relative inability to engage in recreational activities as peers with sighted children, not in any inability to compete on an academic level.
   2. Availability of information: there exists potential for getting much information on "normal" blind children.
   3. The problem of lack of acceptance of the blind by the sighted seems to be one of the most obvious obstacles to integration, thus constituting an important problem.
   4. The lack of special facilities for work with resource teachers.

   Reasons against:
   1. The problem is not urgent.
   2. The present program and facilities are nearly up to the competency level of society to handle the problem.
   3. Inclusion would necessitate investigation of the entire educational system. This is not feasible, within time and our own competency limitations.

B. To include those who are in state institutions, e.g., Sonoma.
   Reasons in support:
   1. Correction of possible mistakes in diagnosis or administered therapy

   Reasons against:
   1. Difficult to get information
   2. The problem is more one of "caretaking" than of remedial action. (Given adequate diagnosis, there will always be those who will not be able to function at all in a sighted environment.)

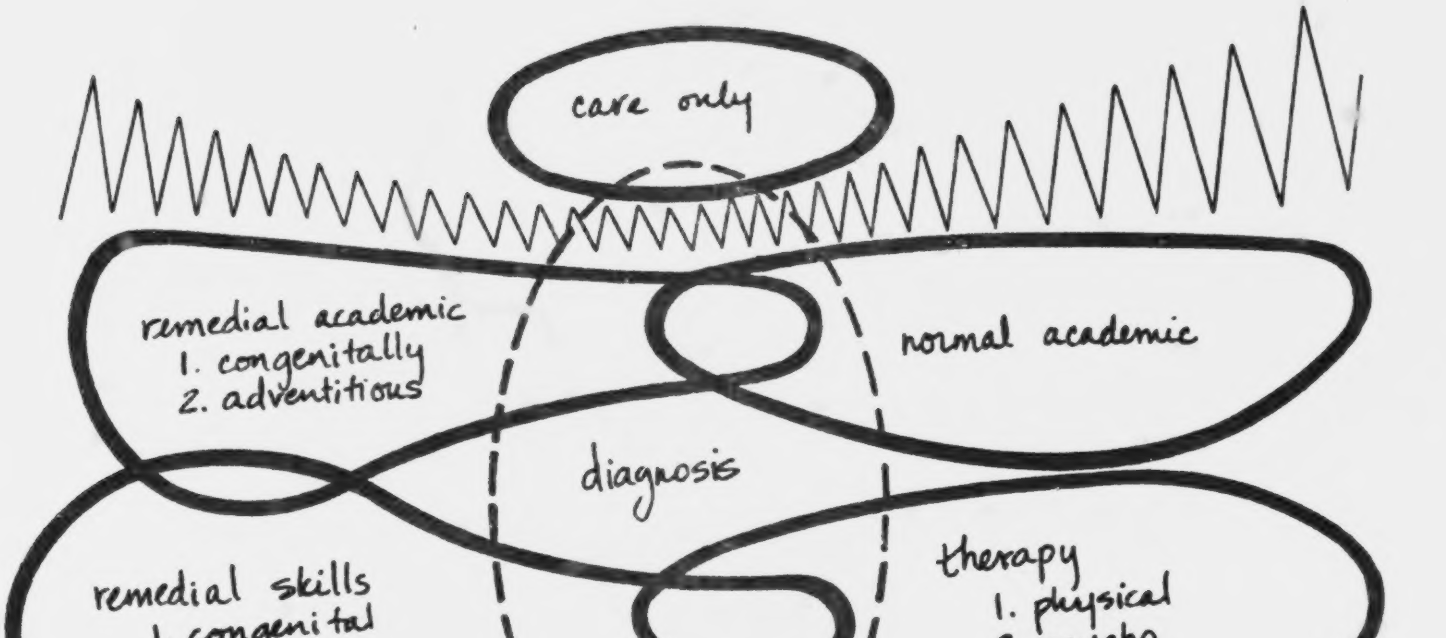
C. To include trained personnel: (teachers, therapists, diagnosticians)
   Reasons in support:
   1. Increase the proficiency of the training
   2. Improve the quality of teachers

   Reasons against:
   1. Lack of information about present training methods and problems obtained
   2. It is not urgent.

D. To include multiply-handicapped (as per diagram)
   Reasons in support:
   1. Information available
   2. Information already obtained
   3. Urgency
   4. Close interrelationships of elements in the diagram
   Reasons against:
   1. Many areas (e.g., diagnosis) need much research
   2. Interrelationship of multiply-handicapped with "normal" blind

Modifications: If certain sub-areas of the diagram prove to be difficult to handle because of unavailability of, or difficulty in obtaining, information, they could be easily dropped. But initially, these areas seem to be closely related enough to warrant consideration and inclusion.

Evaluation and discussion of the proposed alternatives led to the decision to select, as out problem boundary, the education of multiply-handicapped blind children. This decision was justified by the material accumulated and by application of the criteria. A diagram showing the boundaries of inclusion and the needs of those included groups is seen below:


care only
remedial academic
1. congenitally
2. adventitious
normal academic
diagnosis
remedial skills
1. congenital
2. adventitious
therapy
1. physical
2. psycho
blind functioning adequately
in present sighted environment

Blindness, contrary to popular belief, usually involves more than the simple loss of sight. The eye has more direct links with the brain than any other of the senses. Consequently, the loss of sight is quite likely to result in some manner of brain damage. These handicaps are generally more severe if the child has been blind since since birth (congenitally blind) than if he has been blinded after birth (adventitiously blind). Congenital blindness may have one of several causes: (1) The baby may contract rectolental fibroplasia, caused by excessive oxygen in hospital incubators. This was quite a common cause of blindness directly after World War II. (2) The mother of the child may contract measles during the first three months of her pregnancy which results in handicap to the baby in ninety to ninety-five per cent of the cases. Blindness is the most common result; but deafness, neurological damage, heart damage and bone damage also occur. Adventitious blindness is usually caused by accident but also is the result of glaucoma, a disease which deteriorates the eye tissues. Emotional disturbances resulting from the frustrations of blindness and the attitudes of people around the child are common. Although a person may be legally blind (20-200 vision or worse), he may have some degree of light perception. Partially sighted children as well as the totally blind must be considered in the design of an educational facility.

Of the 3129 blind children in California of school age, 1417 (45.3%) are estimated to have additional handicaps. The following breakdown of handicaps occurs:

mentally retarded	1045
neurological damage	342
speech defect	304
deaf, hard of hearing	179
orthopedically handicapped	153
cerebral palsied	137
emotionally disturbed	92
educationally handicapped	44
other	44
TOTAL	2340

In the table above, the total is larger than the number of multiply-handicapped blind children because many children possess several different handicaps in addition to blindness. It may be noted that mental retardation and neurological damage are the two most common additional handicaps. These multiple handicaps keep the blind child out of the public schools and intensify the difficulty of his integration into sighted society.

This integration is often considered to be the major goal of education of the blind. For "normal" blind children, a high degree of integration is often possible. Of the children within our problem boundaries, only thirty per cent will ever become successfully independent and productive. The others can be trained to attain some lesser degree of self-reliance. Facilities should be designed to develop these children, mentally, physically and emotionally, to the fullest extent.

Perhaps as much as his own handicaps, public attitudes towards the blind child often prevent his acceptance in sighted society. Ignorance of blindness often suggests something mysterious for the sighted and fear of this mystery or repulsion at physical difference causes them to avoid personal involvement with blind children. A means of overcoming this prejudice and discrimination must be found, although this means does not lie entirely within our problem boundaries.

Blind children, especially the congenitally blind, perceive the world around them largely through touch and sound. They cannot sense or identify color, depth or other visual qualities of spaces and objects. These things only assume meaning artificially--as given by sighted people. Thus, a blind child may feel a wet, sticky substance and call it blood and call it red not because he can perceive the color, but because he has been told that blood is red. This assignment of artificial, imperceptible values confuses the blind child and makes his integration into sighted society more difficult. The problem is not so great with adventitiously blind children as they have visual memory to draw from. Verbal and graphic communication between blind and sighted is difficult, if not impossible, due to the visual nature of sighted language. The sighted person can only explain his visual environment with visual adjectives; and these words have a very different or distorted meaning for the blind. The blind are pressured into using a visual imagery they do not clearly understand instead of being able to utilize a descriptive vocabulary related more directly to touch and sound which would be meaningful in terms of a blind person's perceptual image of his surroundings.

It is, therefore, something of a challenge to design an educational facility which the blind children can enjoy with their available senses and which will be structured in such a way as to give the blind child full opportunity for development. It was found that very little work has been done in this area. No architectural analysis of the educational and personal needs of blind children was located. There were fragmentary design suggestions--ramps rather than stairs, rounded corners, etc.--but no comprehensive study.

Architectural form and organization can affect the blind child greatly. It can help or hinder his ability to move about with ease and can affect his sense of orientation. The degree and nature of separation of groups and of individual blind children plays an important part in effective teaching and therapy. Information in these areas and many others has been accumulated, digested and, hopefully, synthesized into a valid, abstract, architectural reflection of the factors needed to develop the multiply-handicapped blind child to his fullest mental and physical potential.

Part II: The Process

Why a rational design process.

At present, much of the procedure for the design of complex environments consists in manipulating or, more precisely, "rearranging" the component parts of design problems. And in many instances, particularly where the problems are complex, components are incorrectly identified or exist as simple glosses for whole sets of needs (e.g., 'circulation', 'acoustics', 'social activity', etc.) presumed self-evident. In this way architectural problems are not really solved, but simply assume a different guise.

We have approached the complex problem of designing educational facilities for the multiply-handicapped blind with the idea that the way to raise the design above the level of "rearrangement" was to make a deliberate and systematic attempt to describe explicitly the components of the problem, and to discover through a structured system of needs, those forces not previously seen to work together, and to develop from this system an explicitly stated conceptual solution. The theory and methodology on which our approach to this problem was based is that developed by Christopher Alexander in *Notes on the Synthesis of Form*. Briefly described, the phases of this approach are:

Research:

We cannot attempt to redesign an environment unless we can define its existing characteristics which are bad or harmful--that is, unless we can identify and describe the "misfits" of the present environment. It was necessary, then,--particularly because the majority of us have had virtually no previous experience with blind children--to attempt development of a research protocol--first to familiarize ourselves with the behavior of blind children, and second, to gather design-relevant information (physically relevant information) about the education of blind children in general and multiply-handicapped blind children in particular.

Requirements:

From the data collected in research of the problem, we derived a list of statements of human needs relative to the malfunctioning conditions or misfits in the environment. These "requirements" express those needs which, it is hypothesized, can be provided for in a *physical solution* to the problem. Requirements are the substance of the problem's structure. A requirement is said to have implications for physical form if the need as stated expresses a reason for the form to be one way or another, yet not necessarily suggests a specific form solution.

The form solution is not generated from the optimization of each requirement as a separate element, but from the relational structure between them. The total range of requirements reflects the boundaries of the problem; the subsequent conceptual structure and solution of the problem reflects only those requirements explicit in the program; any deficiency in the solution is clearly related to omission of data (in the research phase) and incompleteness in the list of requirements.

Interactions:

In the interaction phase, decisions are made with regard to the relationships between requirements, which determine the "natural" structure of the problem (program). Requirements are considered two at a time, and a binary judgement is made with the criterion that if, by attempting to solve for one requirement, the physical implication (physical form or organizational structure) of another is changed or affected in any way, the two requirements are said to interact. The change or effect can be one which alters, reinforces or opposes (conflicts).
In many instances, the interaction gives insight into the solution of the problem, or at least a part of the problem; limitations as to the range of possible solutions for one requirement become evident as it is interacted with another; interaction often provides the impetus for freeing oneself of "fixations about solutions", by forcing associations that may not ordinarily be made, but which nevertheless are valid. If the criteria are met, an interaction exists; if they are not, no interaction exists.

Decomposition:

The procedure of decomposition reflects a basic assumption of this method as a rational design process (actually, a heuristic of any 'descriptive' process, e.g., linguistics, botany) that the phenomena accepted as the constituents of a problem are capable of being analyzed into coherent, relatively discrete "sets"; and that, in the case of design at explicitly-defined levels, solution decisions can be made about any one set independently of another. In our process, the decomposition into "sets" is effected by computer operation upon the matrix of binary decisions recorded during the interaction of requirements. The result of several simultaneously conducted computer programs, and an additional amount of handwork, is a hierarchy of overlapping sets (subsystems) of requirements, from which, in stages of combination, a conceptual solution is developed. The conceptual design will not evolve in unitary form, but as an organized assemblage of component subsystems.

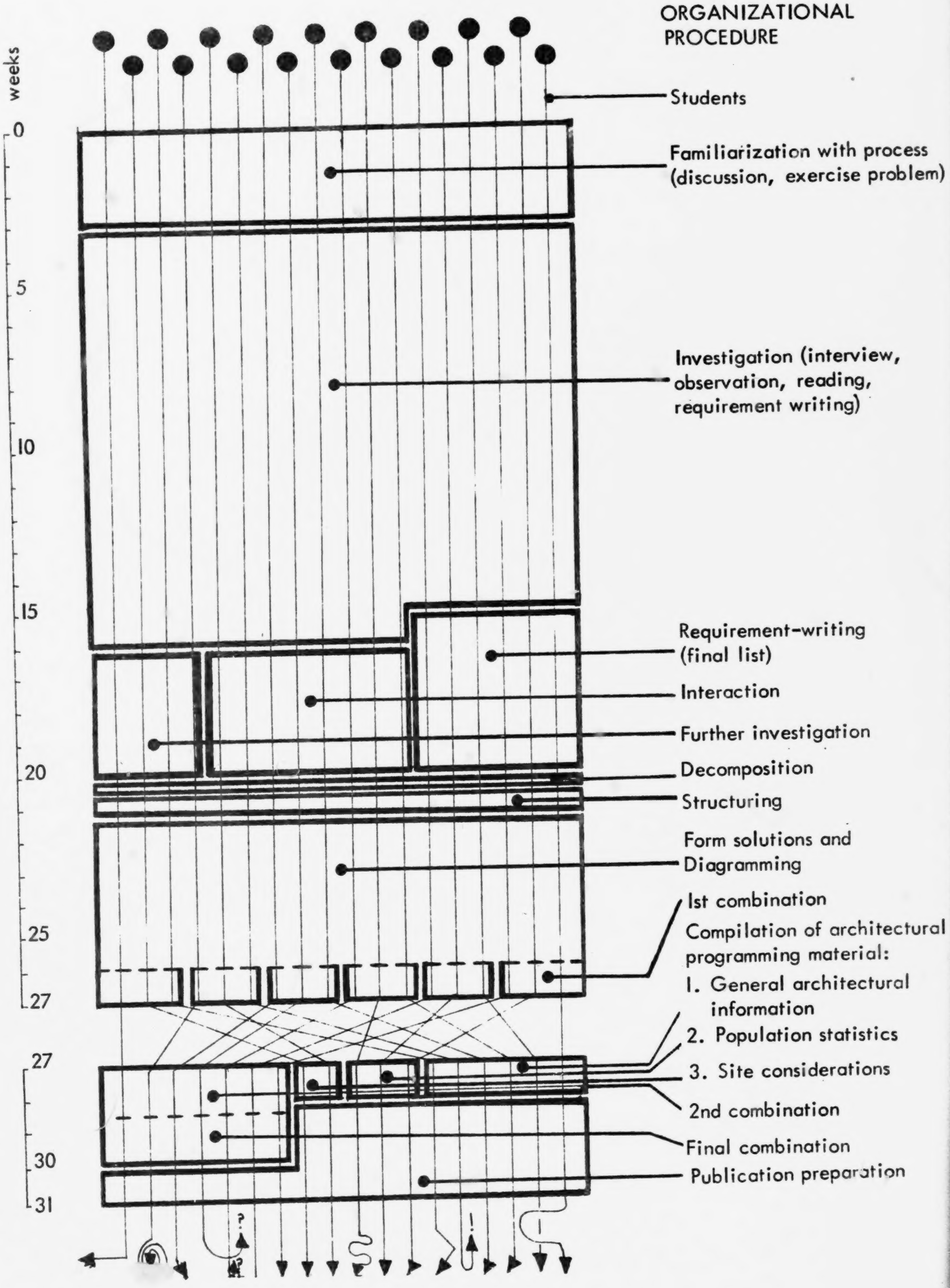
Form Solution:

Each subset and subsequent combination of subsets (according to the hierarchy determined by the decomposition) is "solved" through an explicit verbal and graphic (diagrammatic) presentation of the form relationships (both physical and organizational) derived from individual requirements, interactions between pairs of requirements, and tightly-knit subgroups of requirements within the subset. Whenever possible, the attempt is made to express the solution to the subset graphically rather than verbally; diagrams are used as a way of both manipulating and representing the physical relationships called for in the interactions. It is only at this point in the process that relative strengths of interaction are considered. Each interaction must be satisfied in the form solution, but since some interactions are stronger and more important than others, their effect on the form solution is often greater.

Part III: The Organizational Procedure

The chart on the opposite page depicts the organizational procedure followed by the class during the thirty-one weeks spent on the project. As such, it reflects the number of students involved in any particular phase , the duration of that phase, and the sequence and concurrent overlap of all the phases. The organization within any one particular phase will be described in the discussions on each phase.

ORGANIZATIONAL PROCEDURE


weeks
0
5
10
15
20
25
27
27
30
31
Students
Familiarization with process (discussion, exercise problem)
Investigation (interview, observation, reading, requirement writing)
Requirement-writing (final list)
Interaction
Further investigation
Decomposition
Structuring
Form solutions and Diagramming
Ist combination
Compilation of architectural programming material:
1. General architectural information
2. Population statistics
3. Site considerations
2nd combination
Final combination
Publication preparation
?
?
!

RESEARCH PHASE

RESEARCH PHASE

We began the research phase of the project by "brainstorming" possible topics of investigation. These were formed with the understanding that if they proved to be unprofitable they would be dropped and newly-discovered areas of importance added as they emerged.

The initial topics of investigation were:

1. Orientation
2. Mobility
3. Equipment - personal ; institutional
4. Communication
5. Comparative reactions
6. Perception
7. Adaptation to social variation
8. Discipline
9. Student attitude
10. Social contact structure
11. Synesthetics
12. Means of instruction
13. Content of instruction
14. Previous experiences

The class was divided into two-member teams, each of which was assigned to investigate one or two of the areas below at the California School for the Blind. As the teams worked in these areas they were to research them in terms of the above topics of investigation.

Interviewing:
- -Blind teachers
- -Service
- -Sighted teachers
- -Administrators
- -Parents
- -Children
- -Adult "blind"
- -Multiple handicapped
- -"Blind" only
- -Outside school attenders
- -House counselors

Observation:
- -Classroom
- -"Intensive" classes
- -Graded classes
- -Departmental structure

-Unified classes
-Social life
-Meals
-Organized recreation
-Free play
-Dormitory life

In addition to the above observational and interviewing assignments many students began to read various publications about the education of the blind.

During the research phase of the problem, in order to insure an explicit, comprehensive view of the problem, each team was asked to write a weekly report of the results of its investigations. Copies of these reports were made available to all members of the class, and the content as well as the methods of investigation were discussed in seminar. In the beginning weeks, reports took, for the most part, the form of narrative accounts of interviews, observation studies and book reviews of books and articles. Because most of this beginning investigation constituted simply a random familiarization with the behavior of blind children and the nature of their handicaps, the reports quite obviously presented a somewhat fragmented view of the problem.

As initial areas of investigation were seen to merge, or prove unproductive, it became possible to structure a more logical path of investigation through the various aspects of the problem. Topics of investigation were structured into "sub-problem areas"; reports focused attention on observable or imaginable phenomena in the problem itself rather than on the physical containers or organizational structure now present in the facilities under investigation. For example, research teams concentrated on "student reaction to lack of attention from teacher", rather than on "classrooms" or "elementary classes".

The final realization of what aspects of the problem had been included or omitted, and the relative status of our investigation at any particular time depended to a great extent on the clarity of presentation of these "sub-problem areas" in the team reports. The explicit isolation and identification of these areas was of considerable importance in the transition from data-gathering to requirement writing. The development away from reports which concentrated on describing existing physical environments to ones which focused on generalizable behavioral phenomena helped to establish a level of generality that necessarily had to precede the writing of requirements for a conceptual solution.

Suggested format for report presentation of research included the following:

1. Sub-problem area under investigation.
2. The forms of investigation including all sources used with a comment on their value and application to the sub-problem area as well as to other problem areas.
3. The relevant and useful material uncovered in each sub-problem area and its development into requirements.
4. A list of requirements generated in such areas.
5. An indication of new sub-problem areas to be explored.

There was no formal observational or interview protocol developed at this early stage, probably because we lacked a well-defined sense of what were architecturally-relevant misfits and what types of information would lend themselves to development of good requirements. (See the section on writing requirements.)

Interviewing of individuals concerned with the blind, observations of both blind and the school staff, produced the most valuable information. Books were slightly less productive sources of information. Formal interviews with blind children were, with a few notable exceptions, unproductive, possibly because the blind children had never thought about problems of the type we were interested in examining. This inability to respond to our questions was especially acute among the blind children below the 7th grade level.

The initial information-gathering period lasted approximately 7 weeks, during which time almost all interviews and observation was conducted at the California School for the Blind. Initially the class concerned itself with description of present programs, problems internal to the blind school as it presently functions, and descriptions of the behavior of the blind. By the end of the third week, however, students began to concern themselves with discovering causes for the problems they observed. This concern manifested itself in the increasing number of speculations and questions about the blind in the weekly reports. Students turned to reading about perceptual problems and social problems of the blind.

Much to our later dismay, however, most of these reports consisted of descriptions of the problems and did not delve into the "why" of the problem in a way which would later produce good requirements. Furthermore, problems were described independently of one another, which we later found was little help in understanding the relationship between problems of, for example, perceptual development and social needs. Finally, students began to show an interest in going beyond the school to interview parents of blind children, diagnosticians, etc. But at this point we began to write requirements and organized research ceased for the time-being.

Once the initial set of requirements was reviewed, the class was broken into three approximately equal groups, two of which ceased to research. The following areas of personal interest were pursued by members of the now-smaller research group.

1. The blind child in the public school. His relationship to the sighted. The ability of the blind child to function in sports, dating and general social activities.
2. The nature of the parent-home environment.
3. The sensitivity of the partially blind and totally blind to light.
4. The social status in which adult blind individuals exist, the jobs they hold and what skills they can beneficially utilize.
5. The role of peer groups in the blind child's life.
6. The blind child's relationship to adult authority
7. Investigation of the multiply-handicapped with emphasis on the mentally retarded and physically retarded.
8. Curriculum programming.
9. Available Equipment.

The smaller research group began to pursue these areas in earnest at the start of the second semester. Interviews were conducted with individuals who worked outside the C.S.B. such as social field workers who worked with the blind and their parents in their homes, teachers who deal with the blind in the public school system, and teacher-therapists at other institutes for the handicapped. Notably lacking were interviews with diagnosticians.

After two weeks of additional research, we realized that we were going to have to narrow and define our problem boundaries carefully if we were to attempt to solve a real problem while having adequate information to do so. Had we not narrowed our problem, the information would have been spread too "thinly" since time remained only to fill in the missing information in a small area of the problem. As a problem we selected the multiply-handicapped blind.

Having both defined the problem boundary and attempted to write a few requirements, we now had some idea not only of the areas in which we needed information, but also of how we should go about eliciting and structuring the information in its most useful form. The following format was devised to serve as a guide.

Investigate:
  Program-
    -philosophy of education, treatment; conflicts between schools of thought and the basis of these conflicts.
    -types treated; treatment goals relative to different types.
  Process-
    -the most effective methods; what works and does not work and the reasons for its success or failure.
    -the use and place of records, diagnosis, help, information and co-ordination.
    -what disrupts an on-going process?
    -trends in methods.
    -limitations which might easily be removed to make the process more effective.
  Outside influences-
    -what misfits occur beyond the control of the individual attempting to help a blind child which destroy his influence. Examples: parents, peers, other professionals.
  Equipment used-

After a week of further interviewing and reading, the research group met with the requirement writing group and produced the following list of areas in which we were still lacking information.

1. For the physically-handicapped blind we were lacking information in following areas:
   a. program: what should be done; goals (theoretical)
   b. process: what is being done (practical)
      -what works and what does not work
      -most effective methods

c. hardware availability; its uses and misfits
  -new theories
d. outside influences; parents, teachers, peers
e. mobility

2. For the partially-sighted, we need more information on how they react to light and color. Do they use a different set of mobility and orientation cues than do the completely blind?
3. We have not made much distinction between the congenitally blind and the adventitiously blind. Is there much difference? If so, where, when, and how?
4. We do not have adequate information on the formal course work of the multiply-handicapped blind. (academic program)
5. We do not have adequate information on the dependence of the multiply-handicapped blind on the sighted.
6. We have not considered the developmentally-retarded blind children to the extent that we have the other multiply-handicapped blind. There needs to be more definition between anti-social children and insecure children.
7. We are lacking information about speech therapy.
8. Problems of children in general. (Not necessarily blind)

The research team reported on a few more books and conducted a few more interviews with psycho-therapists and physical therapists.

At the end of the fourth week of the second semester, the class engaged in a requirement writing brainstorming session in an attempt to fill in some of the apparent gaps in the requirement list. A few additional books were read after the brainstorming session, but it was, for the most part, the end ot the research for the project.

Subsequent work in attempting to produce a conceptual solution to the education of the multiply-handicapped blind verified that the above areas still had not been adequately researched. Also lacking was sound information on the needs of the developing child relative to:

A. Changes in social needs
B. Attention span
C. Authority needs
D. Perceptual development in terms of this ability to find his way about and locate objects.

Especially important is the way in which the changes in the above needs relate one to another as the child develops.

Comments on Research Phase:

Unfortunately, the research for an architectural project has often been mistakenly labeled the information gathering phase. The phrase "information gathering" apparently connotes a forray into the environment where the researcher will find plums of delicious information waiting to be plucked. Unfortunately this is not the case, for successful architectural research, demands, as it always has, an ability to ask the right questions which in turn is based in part on a strong sense of what is architecturally relevant information.

Prior to beginning this project most students in the class had thought of architecturally relevant information in terms of presently existing physical form concepts. For example, had the class attempted to design a blind school prior to the present project, they would have found in their investigation that there is a dormitory at the California School for the Blind. A dormitory would probably have been wholly incorporated into their solutions, with the problems internal to a dormitory and the rest of a facility to which the dormitory related remaining, for the most part, unquestioned and uninvestigated.

Consequently, when the class was faced with the initial task of determining the misfits and their causes which existed or had been avoided in the present forms, many students did not know how to proceed and produced only descriptions of the present facilities and programs, devoid of the problems these forms created. Or if they reported misfits, they frequently failed to hypothesize causes for the misfits or to give architecturally relevant misfits.

Much work remains to be done in defining what constitutes an architecturally relevant misfit. The only test we have available at the present time is to ask if the misfit or its cause could in any way be alleviated through manipulation in the realm of physical form available to the architect. If an institution is being designed, sometimes a misfit or its cause can be alleviated with a combination of a organizational or policy change and a new physical form.

While a well developed sense of what constitutes architecturally relevant information is lacking, techniques and guide lines do exist which can accelerate and improve misfit research.

When the research phase is finished the information should be in a form such that the designer can become involved in solving the problem, not in attempting to define it. Defining the cause of a misfit is the researchers job, not that of the designer. This means that the researcher will begin with a large collection of claims about what is right and wrong with the present situation, recorded interactions between people, observations, and reports of research carried on by others. He must then find the forces creating the misfits in each of the problems he observes. This must not be put off until the requirement writing phase, but should be done by the researcher the minute he runs across a misfit.

Pursuing the causes of a misfit is especially profitable and relatively easy to do in the interview situation. To probe successfully for misfit information the interviewer must first destroy the usual preconceptions which the interviewee will probable have about architecture -- that it has little to do with functional considerations and deals mainly with creating aesthetically pleasing forms.

The interviewer must stress that he is interested in the total problem, giving an example of a misfit and how it could have architectural consequences. He should avoid too technical a discussion in an obviously non-architectural realm. For example, discussing the neurological structure of the hyperactive blind child's brain has very little to do with the architecturally relevant part of the education of the blind, while a discussion of the behavioral problems this nervous condition creates would be architecturally significant.

To be useful as a research technique, successful interviewing for misfits requires an alert and well-trained interviewer. A suggested training technique is for the beginner to be accompanied by an experienced interviewer, and to record the interview session on tape. Then in a post-interview session the strong and weak points of the interview can be easily reviewed in a playback of the tape. Even if the neophyte cannot be accompanied by an experienced interviewer, the early interview sessions should be recorded and reviewed.

The training technique of recording and reviewing early interviews might well benefit later research based on observation and reading, since the beginner will have developed a good sense of what questions to ask of the data to produce good misfit information.

The interviewer must realize that in almost every human activity there exists potential misfits that must be considered by the designer. For example in interviewing one teacher about her duties, it was found that she was required to supervise playground activity. Looking for misfits, it was asked what would be the impact of too much or too little supervision. (Here the interviewer tried the "limits" approach to researching misfits -- that is, he assumed too much or too little of anything produces misfits, and attempted to find out what was "too much supervision" or "too little supervision" and the impact of "too much" or "too little".) The reply was that when a blind child knows his activities are continually supervised he does not develop self-reliance. (This reply became requirement #7.) In an attempt to both check the validity of the statement and possible gain insights into other misfits, and their causes, this reply was followed up by the interviewer with a request for case histories where students failed to develop self-reliance because they were continually supervised.

Frequently the interviewer is given examples of things which "go wrong" and he then must try to find the general cause behind the specific examples. If a specific example of a misfit turns up in an interview, the reason why it is considered a misfit must be found.

A number of concepts can be profitably applied to aid in the extraction of misfits. The most general of these concepts is the first, it being:

Disruptive forces:

Given any human activity, there will be frequently occuring situations in which the activity is disrupted. To find and understand the causes of the disruption of the activity, first have the individual outline in some detail the nature of the activity in which he engages (or the nature of the activity of others about which he is concerned) and then ask what can disrupt the activity. Once the disruption is identified then the reason for its occurance must be found.

When interviewing the staff of any institution, the questions can be directed toward identifying disruptions which destroy their effectiveness when they are actually engaged in their various institutionally defined activities. Asking what can destroy the product of their labors when they are not present is also very important.

Those members of the staff who directly serve the users of an institution are frequently engaged in combating forces disruptive to the user. In fact it is the need to overcome these user-disrupting forces which creates the staff member's job. Therefore, an approach to finding these forces is to probe the staff member in depth about why his job is necessary and important. It may be profitable to ask what would happen if no one filled the interviewee's role in the institution.

Institutional controls:

Systems, procedures, policy, rules, and physical forms are or are not used, or followed. For every stated official version there is also an unofficial version. Understanding the reasons for the policy, etc., and why it is or is not followed will produce a large number of actual and potential misfits.

Limiting conditions:

As mentioned in the above section on interviewing technique finding the effects of "too much" or "too little" of any activity, or part of an activity, can produce valuable misfit information. All too frequently architectural information is conceptualized in binary terms -- in terms of commands prefaced with "do this" and "do not do this". Specification of the effects of the degree of intensity is very important design information, and should be avidly sought.

Differences in Approach:

Careful comparison of the methods and philosophies of individuals engaged in an activity with the same nominal title will bring to light a number of differences. The reasons for these differences should be understood, and an attempt should be made to understand and resolve conflicting philosophies.

Identification of Processes:

In any institution there are at least two user processes. The first of these is the aging of the user. As the user grows older his activity interests, social interests, and physical abilities change, with each change bringing about new possibilities for disruptive misfits. A misfit causing force at five may be beneficial at age fifteen.

The aging process of an individual who does not share the problems of the designer must be very explicitly defined, since the designer will be unable to fill in the gaps in his knowledge by drawing on his intuition. The problems of development must be extremely well understood at the early and late years of the human life cycle, since both the rate of change and type of change is more severe and the changes are probably out of the realm of experience of the designer.

The second user process concerns the effects of contact with the institution. As the user becomes more familiar with the institution and as he profits from the services of the institution (or is stunted by them), his needs will change as will the impact of various misfit-creating forces.

Predicting changes:

Most specialists in a field have some idea of what changes can be expected in the near future. Some changes will be desired, others undesired and the reasons for the like or dislike of the projected changes should be found. Also, specialists can be asked what changes they would make in the present situation if they had the power to do so. These statements will serve as valuable indicators of present and future misfits.

REQUIREMENTS

REQUIREMENTS

Definition:

A requirement is an objective statement that, by interpreting observable and imaginable phenomena in the environment, hypothesizes on forces that act to produce these phenomena. It is an insight into an environment problem that furnishes us with knowledge about its causes. In writing requirements, we are attempting to make explicit those misfit (or potentially misfit) force-phenomena relationships which can be effectively reduced through the design of physical and organizational form. The value of a particular requirement is proportional to the degree of new insight and understanding of the components of the problem that is furnished.

It was with this notion that we began to generate requirements from our observations, interviews and readings. In connection with our initial attempts, a great deal of discussion developed over the way in which these statements were to be written. We had available, as a model, the verbal format developed in earlier projects using the same design method. Requirements in the Mental Health Services study, for example, took the form of prescriptions to alleviate misfits.

> --A patient should not be forced to socialize or participate with other patients.
> --A patient must not become overly attached to or dependent on a particular staff member.

In these requirements, a decision had already been made to enable or prohibit the occurence of a force or force-resultant in the solution. Implicit in this decision was an acceptance of a particular "philosophy" for the treatment of the mentally ill. In our case, we found it initially difficult to determine a specific "philosophy" for the education of the blind, other than the summary opinion of educators that effort should be made to involve blind children, to the greatest possible extent, in the educational world of the sighted.

Furthermore, we felt that in order to develop a program which would respond to the educational needs of the blind, a "philosophy of education" any more specific than the one expressed above should develop "naturally", as it were, out of the content and structure of our statements. In other words, we saw the task of writing requirements as a way of building up a desciption of forces which could be used as predicators for the design of physical forms to accomodate these forces. It therefore seemed contradictory to "require" these forces -- as the notion of a "normative" grammar for a particular language is contradictory. In addition, we felt that one should be able to ask the question of a statement, "is it true, or not true?"; and we felt that with prescriptive statements such as those of previous studies, this question cannot be asked. One can only ask of such statements, "is it good or bad?"; value judgements do not go very far in identifying the "true components" of the problem. The requirements of the prescriptive type were prescriptive at a stage in the process when we felt we could not be.

We developed a format for requirements which we called "force-tendency" statements. Actually much more than simply a change in style, we believed that the new format reflected a different and more defensible way of structuring the problem in order to produce results which innovatively responded to the needs of the people and procedures of our problem. Our aim being descriptive rather than prescriptive, we saw requirements as "functions" -- as a relationship between observable forces and observable resultant misfit or malfunctioning situations in the environment. These force-tendency statements express a dependency or contingency of one statement of fact upon another. Where a mathematical function states that "a is greater than b", a force-tendency function takes the form, "if a, then b". Observable facts are brought together in such a way as to illuminate the relationship between a malfunctioning situation (tendency) and its cause (force).

For example, several observations are recorded:

--It is more difficult for the blind than for the sighted to distinguish between 'stable' and 'unstable' elements of any physical environment.
--A blind child (at least a perceptually immature one) has difficulty seeing his physical environment as a continuum. This will affect the establishment of a conceptual continuum, a continuum of ideas.
--Tactual perception is an on/off process.
--Auditory perception, while it may provide a continuum, is often operationally ineffective because of a difficulty in defining the source or location of sounds.

From these statements of fact, some of them suggesting misfit situations, a relationship (function) is established:

(Requirement #13)
By mistaking a moveable object for a stable one, a blind child can misorient himself if he determines his location relative to that object.

In the development of force-tendency statements, it was often the case that a relationship was assumed (or intuited) from statements of fact; that is, we ourselves could often not determine the probability of a relationship through direct experience. But the assumption was made from statements which were empirically verifiable (includes appeals to authority); therefore, the assumed relationships can be considered "verified".

In the prescriptive requirements, the forces which generate misfits, as well as the misfits themselves, are at best implicit; we strongly felt, in our approach, that because an understanding of these forces would enable a designer to make unambiguous decisions in correcting misfits, the relationship between a misfit and its cause(s) should be made explicit.

Take, for example, the force-tendency statement:

> (Requirement #69)
> If parents do not understand the procedure for their child's diagnosis, they may neither accept the diagnosis nor support prescribed therapy.

If we had simply said, "parents should be able to obtain information about the procedure for their child's diagnosis", or something to that effect, we have only implied the existence of a misfit, but we have expressed very little understanding of why its occurence is undesirable, what its antecedents are, and have thus effectively reduced the amount of influence that we, as designers, can have in reducing or controlling its occurence. With the force-tendency statement, on the other hand, we are now made aware of what may happen if parents are not able to obtain information about a diagnostic procedure. We see that a misfit or malfunctioning situation in the environment is a composite of an event -- in this case, a parent not understanding a diagnostic procedure -- and an undesirable result contingent upon this event: namely, a parent not willing to support prescribed therapy.

Because we have been made explicitly aware of a particular cause and effect (force-tendency) relationship, we are in a much better position to make decisions about controlling the cause in order to avoid an unwanted effect.

Difficulties in writing force-tendency statements

Now, a cause and effect relationship is a rather simple notion to grasp. But in our efforts to generate a list of statements which would comprehensively describe the force-tendence relationships within our problem, writing requirements involved much more than a simple matter of expressing a relationship within a cause and effect construction. It cannot be overemphasized that, as statements which establish the components of the program, and thus the basis for the conceptual structure of the problem, requirements (force-tendency statements) must create a consistent and comprehensive conceptual frame of reference; without specific criteria for selecting and limiting the way in which the descriptions are made, induction of a conceptual solution from the sum of these particular descriptions can become wild and unmanageable.

We accepted, to begin with, a set of criteria which had been developed for previous studies using the same method:

First, a requirement must be clearly expressed as a reason for the form to be one way or another. It should not suggest a particular form-solution, but it should provide an unambiguous decision to be made during the subsequent interaction of requirements.

Second, a requirement must reveal its own significance and validity by implying the damage that will be done if the requirement is not satisfied.

For example, an earlier version of requirement #74 read:

> If aids for instruction or therapy are not easily accessible to their work, teacher-therapists will be reluctant to use them.

In this statement, the misfit is not clearly expressed; it is unclear what persons or procedures would be adversely affected by the lack of accessibility of instructional aids. Further, the phrase "not easily accessible" is so vague as to preclude an unamibiguous decision concerning the range of possible solutions which would reduce or obviate the misfit. The reason for the form to be one way or another is not made explicit. The requirement was rewritten to read:

> If materials or movement necessary to effect an activity cannot be applied without disruption or delay, teacher-therapists often disallow the activity.

Here, the notion of disruption or delay permits a clearer estimation of the force that may produce a misfit situation; this, in turn, allows for the expression of a more significant misfit than was evident in the first statement.

In another example--

> (Requirement #67)
> If an administrator is not encouraged to observe routinely an educational program in actual practice, he cannot evaluate its effectiveness.

The solution range is too restricted. The phrase "encouraged to observe routinely.." suggests, too strongly, a particular solution to the misfit; it already limits the possible ways in which an administrator can become knowledgeable about an educational program to "direct observation". The statement was rewritten to read:

> If an administrator is not familiar with the functioning of an educational program, he cannot evaluate its effectiveness.

It is now possible to admit other means of solution besides "direct observation", yet "direct observation" is still clearly within the solution range.

Third, a requirement must be a complete statement, as independent of other requirements as possible, and generalized to the level at which all, and only, the possible physical consequences of one force are implied. It must not depend on existing or preconceived solutions or the existence of another requirement, in order to have meaning relevant to the problem.

In generating force-tendency statements from statements of fact, or misfits, an attempt must be made to insure a common "level of generality" among these statements. That is, in trying to establish a force-tendency relationship between a hypothesized causal force and the resulting malfunctional situation, we must try to state the relationship in a form removed from the actual physical situation in which the cause or effect was observed, in order to free our thinking from present solutions. But we must also be careful of generalizing the relationship to the degree that it covers more than one force-tendency field.

For example, we begin with several observations:

- --blind children perceive objects primarily through touch
- --blind children like to run
- --blind children fear running into objects
- --blind children restrain themselves from running
- --blind children often injure themselves by tripping over and bumping into various objects.

An attempt at a cause and effect statement is made:

> Blind children like to run but restrain themselves for fear of running into objects; or,
> Blind children like to run but restrain themselves for fear of injury.

Both of these attempts are rejected because they are too specifically tied to observed events. An attempt is made to generalize:

> Because a blind child perceives objects through touch, he often inhibits his movement because of fear of injury.

But because of an overlap with other force-tendency fields (cf. appendix A), this statement is felt to be too general , and we write:

> Because a blind child fears injury to himself or others, he is often hesitant in moving through unfamiliar surroundings.

Fourth, a requirement should have imaginable implications for physical or organizational form that will serve as a basis for interaction with other requirements. Organizational form is meant to imply non-physical structure (e.g. social organization, policy, etc.), which may prove to be a strong determinant of physical form. For example, the statement:

> (Requirement #69)
> If parents do not understand the procedure for their child's diagnosis, they may neither accept the diagnosis nor support the prescribed therapy.

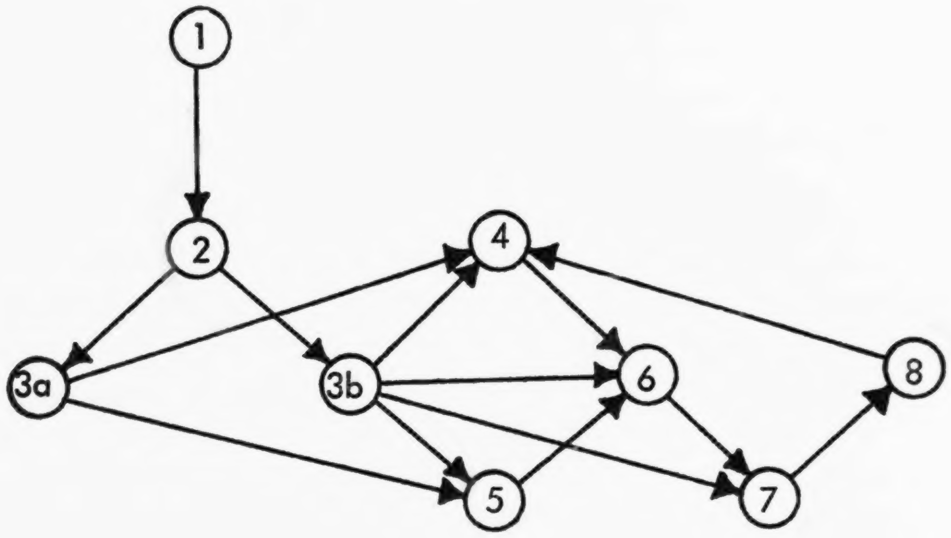
The implications for organizational form may become clear if we propose hypothetical "solutions" to this statement. For instance, one way of insuring that parents understand a diagnosis is to create, by policy decision, a role for them in the diagnostic procedure; another way might be to insist upon lengthy conferences between parents and diagnosticians. Both of these organizational "solutions" have potential as determinants of physical form.

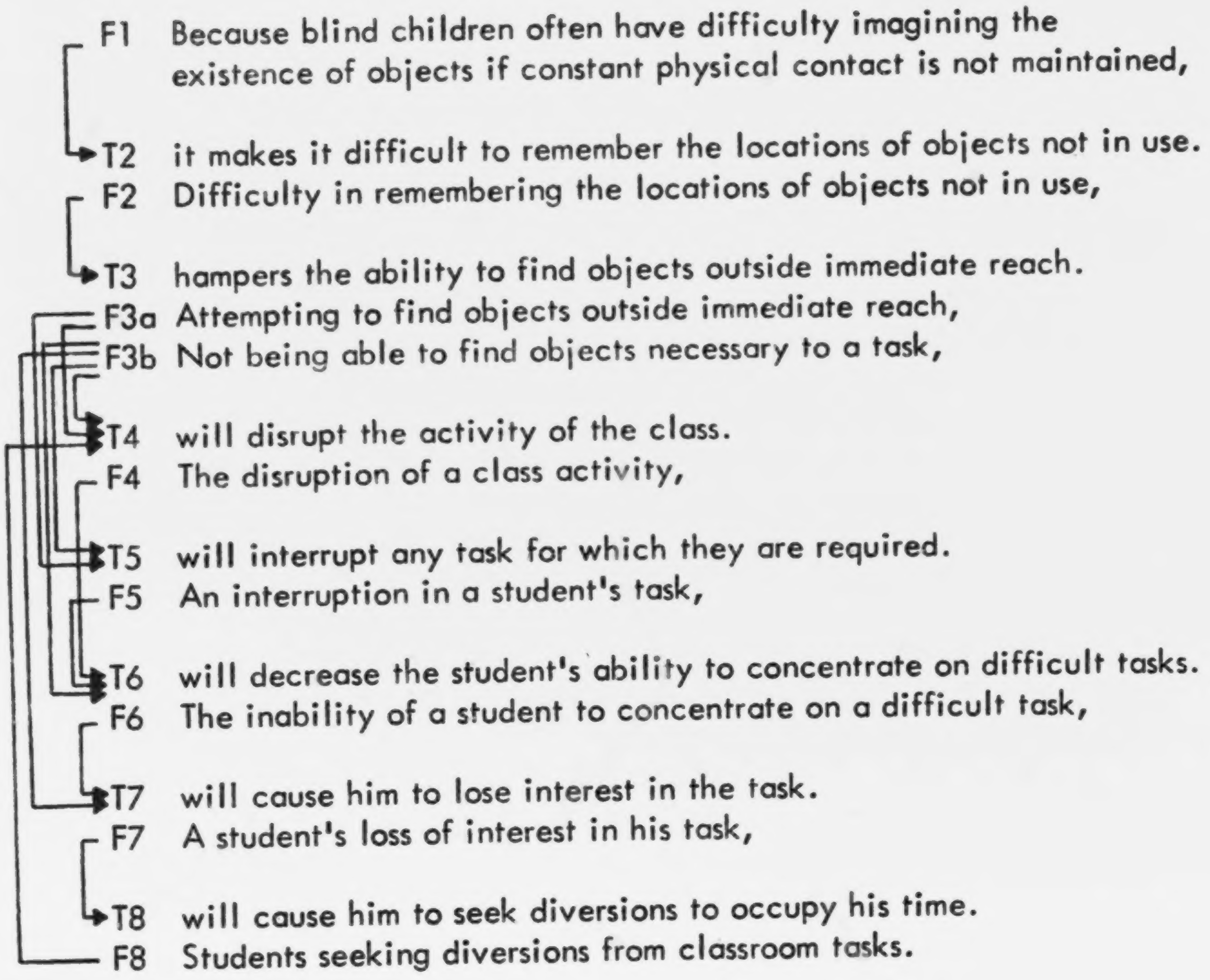
A word about the procedure for requirement writing should be interjected at this point. At that time in the research phase of the problem where we began to structure information in terms of "sub-problem areas", we were also beginning to discuss the nature of requirements and to determine criteria for writing them. The entire class was involved in trying to write requirement-type statements reflective of the "sub-problem areas" under investigation. When a list of about 300 statements had been compiled from these research reports, certain members of the class turned their efforts from data-gathering to re-writing the requirements of the first list. (In addition, as the redundancies on this initial list were eliminated, new requirements were written in areas of investigation previously not dealt with in depth, or omitted entirely). In effect, this rewriting constituted much more than a simple matter of "polishing-up" the statements of the initial list. A considerable amount of time and effort was spent in further developing the "theory" of force-tendency statements, in obtaining finer-grain criteria than discussed above.

New Criteria

In writing force-tendency statements it became obvious that the statements of fact-generating relationships could, when taken independently, be capable of functioning either as forces or tendencies; in other words, any one statement of fact could in one relationship act as a force, and in another exist as a resultant of a different force. As either a force or a tendency, a statement could be brought into relationship with a new statement of fact, which in turn, acting as a force or a tendency, could exist as a terminal of another function, thus creating a "chain" of related statements.

An example of a force-tendency chain follows, with criteria established for the isolation of the most useful statement in the chain:





F1 Because blind children often have difficulty imagining the existence of objects if constant physical contact is not maintained,

T2 it makes it difficult to remember the locations of objects not in use.
F2 Difficulty in remembering the locations of objects not in use,

T3 hampers the ability to find objects outside immediate reach.
F3a Attempting to find objects outside immediate reach,
F3b Not being able to find objects necessary to a task,

T4 will disrupt the activity of the class.
F4 The disruption of a class activity,

T5 will interrupt any task for which they are required.
F5 An interruption in a student's task,

T6 will decrease the student's ability to concentrate on difficult tasks.
F6 The inability of a student to concentrate on a difficult task,

T7 will cause him to lose interest in the task.
F7 A student's loss of interest in his task,

T8 will cause him to seek diversions to occupy his time.
F8 Students seeking diversions from classroom tasks.

The following is a working list of criteria for the isolation of a force-tendency statement in a chain:

1. The components (force-tendency) are the most easily understandable.
2. The components give the most information and insight about the major phenomena represented.
3. The statement has a high degree of potential falsifiability. (verifiability)
4. The causal connection between force and tendency minimizes any possible intermediate linkages. (i.e. they are strongly linked)
5. The physical implications of the statement are the most numerous and the most clearly understandable.

From the chain described above, (F2 - T3) was selected as best fitting the criteria. This relationship is expressed in requirement #30:

> A blind child's difficulty in pin-pointing the locations of objects not in use hampers his ability to find objects outside immediate reach when they are needed.

It can be seen from the example that, in addition to the simple chain effect, it is also possible to establish a single force resulting in more than one tendency, (F3a - T4, T5); and a single tendency as the resultant of more than one force, (F3a - F3b - T4). The criteria are again applied to determine the most useful statement.

Evolution of a requirement

The writing of a force-tendency statement (requirement) involves statement verification and much verbal intrigue in exploring the implications (physical and associational) of words and phrases to be used. It is necessary to express as succinctly and unambiguously as possible, a specific force and its resultant tendency. The misfit in the situation must be made apparent. An example, showing the stages in the writing of Requirement #8, will serve to illustrate requirement-writing procedure.

A force or tendency describing a misfit serves as a starting point:

"Students who cannot find a teacher when seeking individual help will...."

For this force, the tendency, "will be frustrated" was considered, but it was determined too general. There was no indication of what the impact of the frustration was. Knowing the impact of the frustration is important because it indicated:

--the severity of the misfit caused by the force.

--the direction to be taken in coping with the impact. The frustration itself cannot always be dealt with.

More specific tendencies were substituted:

A. ....they will not return for help later.

B. ....they may attempt to release frustration in aggressive action

C. ....they will quit working on the problem, developing negative feelings toward the problem and/or help-giving situation.

These three tendencies were rejected because:

--Given the above force, these tendencies would not always occur.

--Tendencies A and B somehow did not get at the most significant effect of the frustration.

--Tendency C is just a longer definition of the word, "frustration", (i.e, "....developing negative or rejecting feelings toward the problem and/or help-giving situation ") The first part of C, "quit working on the problem," says nothing about the misfit impact of such a reaction to the force.

At this point, it was realized that the initial force could be generalized to include more than the purely educational situation. (Many so-called "solution-oriented requirements are actually a particular case of a more general force-tendency.) The initial force was rewritten as:

"If aid is not accessible to children seeking help...."

"Help" and "aid" now included many kinds of help, including educational, therapeutic, counseling service, or parents. Thus, the force had been generalized. Avoiding hyper-specificity is important in writing requirements; however, if a force or a tendency is generalized to too large a degree, it:

--interacts with everything

--has too many different possible causal forces or causes too many different tendencies to be meaningful.

Revising the tendency once more, the statement became:

> "If aid is not accessible to children seeking help, their potential improvement will be thwarted."

The following criticisms were made of this statement:

- --The word, "accessible", implied that the problem dealt with physical accessibility to existing aid. The force could be made even more general substituting the word, "available", suggesting not only the misfit of accessibility but also of availability.
- --The type of aid being sought--that which would lead to an improvement--was too vaguely defined. The type of improvement was not clear.

Another re-write was attempted:

> "If help necessary for improvement is not available when he is seeking it, a blind child may not be able to improve."

It had already been said in the force statement that the help necessary was necessary for improvement. If unavailable, there could not--in terms of the force as we defined it--be any improvement. The force was being restated in the tendency statement--a common error in requirement-writing.

It became apparent at this point that the statements gave little indication of whether or not the misfit could be corrected through physical or organizational form; that is, the statements gave no clear reason for the form to be one way or another. About the only response one could make, when confronted with the fourth version, is simply to say, "make assistance available when a child needs it". The misfit, stated as a tendency, does not provide an unambiguous directive for the control of the force through physical form. Saying that a child's progress in an activity will be retarded if he isn't able to obtain assistance when he needs it does not tell very much about how this need for assistance related, in a physical way, to a misfit-tendency.

It was then attempted to generate more specific resultants of the force, "if help is not available...." The tendency which was accepted as being the most useful now made the statement read:

> "If a blind child cannot get help from a teacher when he needs it, he may disturb other people around him by asking them for assistance."
> (Requirement #8)

The tendency now allows for a range of physical solutions to be brought to mind and either accepted or rejected as corrections of the misfit.

Requirement Evaluation

The most significant difference between the verbal program of this study and those of previous studies is to be found in the interpretation and explication of data as "functions," in the structuring of the components of the problem as cause and effect relationships (force-tendency statements). The methodological advantages to be derived from concentration on functions (relationships) are far-reaching:

1. The impact of a rational approach to design, at least as developed by Christopher Alexander, is to be found in the fact that a solution to complex problems is generated from an interrelationship of components, and not from an attempt to solve misfits piecemeal. Compared with previous studies, the present one takes advantage of the importance of interrelationships at an earlier, more primary, level of description. The statement of the components as relationships permits objective description at a stage in the development of a program where objectivity and description are justifiable ends in themselves; the disadvantage of allowing the personal prejudices or private experience which enter into subjectivity is much greater if the components of a problem are seen as unique occurences of fact.

2. The structuring of information as relationships (functions) allows for development of the force-tendency "chain" discussed previously. The explicit recognition of these "chains" can, in fact, be seen as advantageous, because it permits a classification of data and a subsequent unification and generalization that is difficult to achieve when the components of the problem are predicated individually. A force-tendency statement is, ideally, a generalization of a relationship seen to be invarient in a larger body of recorded information; as a generalization it permits the manipulation of related "bits" of information in condensed form. The selection of one statement of relationship out of a "chain" as being the most useful does not mean that the other functions expressed in the chain are not valid. The propriety of any given function is not inherent in the data itself, but is an evaluation imposed by the point of view brought to bear on it, e.g., the purpose for which the program is undertaken, in this case, educational facilities for the multiply-handicapped blind . Without the possibility for generalization, for establishing a "principle of reduction" of components, information (facts) can only be ascertained and recorded as quickly and as often as possible.

For those who would hope to benefit from the use of this study as a model for an approach to design problems of similar scope, it would be worthwhile to discuss several of the difficulties, both procedural and methodological, that were incurred as a result of the development of force-tendency statements.

1. Much of the factual material that went into the making of a force-tendency statement was not made explicit. This was particularly disadvantageous in a group-and-team effort, where those who were gathering information and making initial attempts at writing force-tendency statements, and those who, through collation and re-writing, were trying to form a coherent verbal program (final list of requirements) were not the same group of people. It was often the case that the "re-write" team had considerable difficulty determining the relevance or usefulness of a particular statement, where the relationship was ambiguously expressed, and where there was no recorded input to help in resolving the ambiguity. Because of this lack of explicitness, it can be reasonably assumed that there was a certain amount of information lost, which would have been relevant to the problem.

2. The attempt to structure information in terms of relationships presented difficulties in the translation of material gathered in interviews and observation into force-tendency statements. A good deal of information relative to any one "sub-problem" area had to be gathered and assessed before significant cause and effect relationships could be established. In addition, people being interviewed (or observed) are more apt to generate information couched in prescriptive terms (e.g. "blind children should be instructed individually," or "a blind child should be encouraged to develop extracurricular interests"), which, in this case, we were seeking to avoid.

3. An operational premise of this approach to design is that the verbal program is comprised of statements which are relatively independent of one another, and of a common level of expression and generality. Difficulties in achieving this common level of expression in force-tendency statements were due, in part, to the ambiguity resulting from a lack of pre-requisite explicitly-stated factual material, as discussed above; and to the absence of a really coherent and unambiguously-expressed set of criteria for determining an appropriate level of generality. As a result, it was often the case that those force-tendency relationships which were more cogently expressed, thus more easily understood, became the most dominant directives of the solution, irrespective of the importance of content.

INTERACTIONS

INTERACTIONS

A set of requirements has been written. This set represents the end of the problem's analysis and the beginning of the synthesis that will produce its form solution. These requirements must be considered collectively if the ultimate solution is to be an accurate reflection of their demands; collectively only as it is assumed possible to determine subsystems of variables that are particularly interrelated, and admit solutions relatively independent of one another. In spite of the fact that the description created by the set of force-tendency statements (requirements) is imagined to be a coherent structure--a continuous network of functions--it is hypothesized (as a premise of a rational approach to design, in analogy with scientific method) that there are portions of the continuum which behave as though they were isolated. There are component-clusters of relatively high density surrounded by areas of comparatively low density, and it is these comparatively thin areas which permit a certain measure of independence in the establishment of subsystems.

Each requirement has its own set of form implications. Form implications indicate the range and nature of physical or organizational form necessary to give effect to the requirement. When requirements are taken as duads, their individual form implications may affect each other in one of three ways: they may conflict; they may alter each other; they may reinforce each other. When the form implications of requirements affect each other in any of these ways, the requirements are said to interact. Some examples may help to clarify this interaction further:

Example 1:

> Requirement #16: A blind child's communicating with others often interferes with their individual study.
>
> Requirement #27: If other children are outside immediate reach, a blind child has difficulty establishing and maintaining communication and social interaction.

There is a conflict apparent between these two requirements. Number 16 calls for separation of children in order to cut down communication among them and, thus, to encourage individual study. Number 27 implies proximity of children to the extent of being within "immediate reach" so they can maintain communication (communication for the blind depending strongly on touch). These two requirements interact by virtue of their conflicting physical implications. That is, imaginable solutions to the first requirement, if given full realization, would make it difficult to achieve simultaneously an adequate solution for the second requirement. It is important to recognize conflicting relationships between requirements as "interactions" because, eventually, the solution will have to resolve these conflicts (perhaps through compromise) if it is to be successful.

Example 2:

Requirement #16: A blind child's communicating with others often interferes with their individual study.
Requirement #58: Because a hyperactive child often releases excess energy without regard to its effects, he disrupts his own or others' academic tasks.

In this instance, *reinforcement* occurs between these requirements. Number 16, as previously stated, calls for separation of children. Number 57 also implies a separation of children, especially hyperactive children, so that their activities will not disturb others. These two requirements interact by virtue of this reinforcement. That is, imagineable solutions to one requirement may constitute a partial or complete solution to the other. When formal implications are the same, the interaction is given more importance than other types of interactions.

Example 3:

Requirement #16: A blind child's communicating with others often interferes with their individual study.
Requirement #8: If a blind child cannot get help from the teacher when he needs it, he may disturb people around him by asking them for assistance.

In this case, the implications of #16 are *modified* by those of #8. Requirement #8 calls for a communication link between individual students and the teacher--a link that could be utilized by an individual without disturbance to others. Requirement #16 implies an absence of communication. This implication is altered in that student-teacher communications must be made possible without disturbance to (communication with) other students.

Example 4:

Requirement #10: Objects with similar forms and physical properties but different in purpose or intent are *confusing to a blind child.*
Requirement #26: *Confusion and insecurity in an unfamiliar environment* often inhibit a blind child from seeking aid.

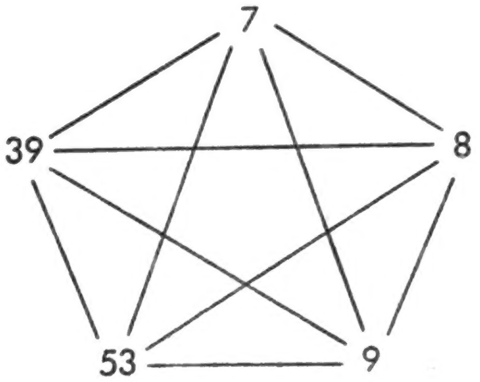
These two requirements may, at first glance, appear to interact because both statements deal with the "confusion and insecurity of blind children in an unfamiliar environment." In the first statement, this fact is asserted as a tendency, in the second, as a force. If we establish an interaction simply on the basis of a similarity between the force of one statement and the tendency of another, we have, in effect, taken into account only one-half of each statement. The purpose of interaction is to establish connections between *misfits,* based on a judgment about the physical or organizational form implications. And a misfit can only become evident in a statement of *relationship* between two phenomena, as a sort of energy released when a force and its resultant tendency are made explicit. Thus, interacting only one-half of each of the statements is not the same as interacting *misfits*.

> As the form implications for each of the two statements are developed, it becomes clear that these implications are neither in conflict nor in concurrence with each other, but are unrelated. Requirement #10 simply calls attention to the relationship between the physical properties and form of objects and the difficulty a blind child has identifying these objects. Requirement #26 talks about the receiving aid because the child feels confused and insecure.

It should be emphasized that there are, effectively, two phases of interaction, one operation quite distinct from the other in terms of the amount of insight resulting from the links established among requirements. The first phase, which can be termed "initial interaction," has been described above. Interactions established in this initial operation are reflections of simple binary judgments; that is, a "link" is of an existing/non-existing nature, and all are of the same strength. No attempt is made at this point to determine the relative importance of one link over another. Interactions thus established reflect a comparatively superficial understanding of the interrelationships since subsystems have not been isolated.

As a result of decomposition and re-structuring, subsystems are isolated in which each requirement has a high number of interaction links with other requirements in the subsystem. In order to weight the interactions, to assess the relative importance of connections between requirements within the subsystem, it is necessary to restate, in some cases redevelop, the content of each interaction. Where in the initial operation interactions reflected a binary judgment, they must now generate the content of subsystems, from which solutions will be developed. Each interaction-function will take on an expanded significance, simply because its proper place within the network has been articulated. And in some cases, two interacting statements (requirements) will occur in more than one subsystem; the difference in the content of subsystems will necessarily force a difference of interpretation in the interaction in each of the subsystems in which it occurs.

The importance of individual interactions becomes more apparent in the decomposition phase of the design process. Requirements are structured, through decomposiotion, into highly interacted clusters; called "subsystems." These clusters have e enough similar, or interacting, form implications to give them some sort of topical unity. They are composed, for the most part, of groups of fully interacted requirements called "simplexes." An example of a five-way simplex is shown below. Numbers represent individual requirements; and the links between them represent interactions.



The form implications in this simplex can be drawn out into a single, comprehensive statement expressing the new relationships created by "interaction of interactions." When sets of simplexes, along with other densly interacted requirements are combined into a subset by decomposition and subsequent structuring, the final phase in synthesis is approached. In this final stage, all new implications possible are drawn out of interactions within subsystems; and these are modified and combined into a single, final, totally comprehensive form solution (a diagrammatic/verbal representation of the necessary from relationships).

Interactions in this study were carried out by an eight-man group working in teams of two. Requirements were divided up among these teams, half taking odd-numbered requirements, the other half, even-numbered ones. These were then divided further. Each two-man team was given half the odd or even-numbered requirements to interact. Thus, a full matrix was interacted to control internal consistency. Teams worked independently and met as a group, for comparison and resolution of discrepancies. Interactions for each requirement were recorded separately with a written commentary on the nature of each interaction.

DECOMPOSITION AND STRUCTURING

DECOMPOSITION AND STRUCTURING

There were three computer programs used in the decomposition of the graph of the entire lattice network of interactions. Briefly, their functional differences are: HIDEC splits the graph into halves; then splits each of the halves in two, and follows this pattern until no set contains more than eight requirements. Each split is an attempt to partition the set so that the fewest number of interaction links between requirements are cut while, at the same time, attempting to maintain an equal number of requirements in each of the halves. The result is a list of discrete sets of requirements with each requirement appearing only once and a "tree" hierarchy representing the succession of splits.

HYPAP selects those sets in the graph that have a relatively high density of internal linkages. The result is a list of sets with a mathematical function indicating each set's density relative to the density of the entire graph. Requirements with a relatively high number of interactions may appear in more than one set. Requirements with a relatively low number of interactions may possibly not appear at all. There is no hierarchy established.

SIMPX prints out all the completely connected sets in the graph, that is, all sets in which every pair of requirements is linked.

Four additional programs, HYPER, BLDUP, EQCLA, and STABL, were not operational at the time of the decomposition phase. The three programs used, however, were sufficient for structuring the graph.

The process of structuring becomes one of superimposing the programs so as to define both those sets with high internal density and the hierarchy indicating their successive combination into the whole set. The majority of interaction linkages should be intact at the lowest possible level of the hierarchy without excessive duplication of requirements in the sets. Appendix B contains the results of the decomposition programs and the evolution of the final structure. The final structure contained seventeen subsystems and four levels in the semi-lattice hierarchy.

FORM SOLUTIONS AND DIAGRAMMING

FORM SOLUTIONS AND DIAGRAMMING

Preliminary Development:

Although insight, intuition, and some sense of the total problem have been necessary at every stage preceeding diagramming, it is at this point that the emphasis changes strongly from analysis to synthesis. In attempting to solve the semi-independent subsystems of strongly interacted requirements, a new set of procedures must be adopted. Diagramming is not simply the production of a set of graphic symbols, but involves some initial development of the subset. For those attempting this form of problem-solving for the first time, this initial development is most easily accomplished as a verbal exploration of those conditions which the final solution must satisfy. This helps in focusing in depth on the total range of possible solutions to each requirement and to the various interactions within the subsystem. Many students expressed the belief that it was the in-depth investigation of the possible solutions to a small number of interacted requirements which significantly altered their preconceived solutions to the problem, providing them with more new insights than would have been possible using other approaches. Since many of these insights were fragmentary in nature and were rather abstract, verbalization helped capture these concepts with greater ease than would have been possible by an immediate plunge into diagramming. The point of verbalization is not to expand the amount of information but to synthesize it and transform it into a physical form solution. The procedure employed in arriving at the form solutions was as follows.

At the completion of the decomposition, each member of the class received one subsystem which he was to develop into a diagrammatic solution. (Subsystem "F" was so tightly interacted and so large that it was assigned to two individuals.) As basic material from which to begin the development of the form solution, each individual received:

A. A page on each requirement in the subsystem with all of its interactions and the notes on the physical implications of each of these interactions as written by the interaction team.
B. A diagram of the subsystem (See subsystem "N", appendix B, page for example) indicating:
   1. Requirements that occured only within the subsystem.
   2. Requirements that occured both within the subsystem and in other subsystems.
   3. Interactions (links) between the requirements in the subsystem.
   4. Interactions (links) between the requirements in the subsystem and requirements located in other subsystems that were not intact at the subsystem level. "Cut and missing link" was the name given to such interactions; "cut link" because on the lattice the line indicating an interaction between subsystems was "cut" or not present, and "missing" because the same interaction (link) did not appear within another subsystem. (Since one requirement could appear in more than one subsystem, links that were cut between subsystems could appear in another subsystem and thus would not be " missing".)

C. A statement of the suggested procedure to be used in developing the diagrammatic solution.

Each individual re-interacted all of the requirements in his subsystem to be certain that he agreed with the initial decision of the interaction team. A few minor readjustments were made, but in general the original interactions were accepted.

So that other members of the class could have some idea of what the various subsystems dealt with, each student wrote a short statement about the apparent relational topic of the subsystem. An example would be:

> "This subsystem deals with supervision and structure of activities, availability of aid, and how these factors relate to the education of the blind child."

Next, the form implications of each individual requirement were developed. A form implication is the result of an intuitive leap. It is not an actual form relationship. It is, instead, a statement of the type of conditions which the yet to-be-solved form relationship must satisfy in order that the misfit indicated in the force-tendency statement (requirement) can be eliminated. Examples of form implications would be: "an area free from direct supervision", "immediate access to aid without disturbing others", "immediate individual attention within a group." A form relationship, on the other hand, specifies the actual configuration of the form necessary to solve the form implications.

When a requirement was only contained in one subsystem, it was important to solve that requirement as completely as possible. Any of its implications which were neglected at the lower level would probably be lost at the higher levels of combination since its implications would be developed in no other form solution, and thus could be over-whelmed by those form solutions which resulted from requirements which occured in more than one subsystem.

After the development of the form implications of each individual requirement, the members of the class used a variety of approaches in the development of the subsystem. Some individuals intuited the form implications necessary to solve the problems created by the interaction of two force-tendency statements. Others skipped the consideration of these two way interactions, and concentrated on three, four, or five way simplexes as a second step after considering the individual requirements. Still others concentrated on the overlapping patterns of the interacted clusters within a subsystem. Many did all of these.

As pointed out in the section on interactions, the form implications arising from the considerations of interactions within the context of the subsystem are usually more significant and important than those arising from the individual interactions made in order to establish the structure of the problem. Their importance can be attributed to the necessity to solve all of the requirements and interactions of a subsystem as they influence each other and not as individual entities.

Without running a series of experiments to compare the differences in the results obtained by the above methods of considering interactions, it is impossible to say which approaches, if any, yielded a more comprehensive set of results.

Once the form implications of the subsystem had been intuited, the redundancies were removed and a concise set of statements was produced. These consensed form implications were labeled solution statements, and they were the last set of verbal statements developed prior to the beginning of diagrammatic development of the form relationships. Some examples of solution statements follow:

1. The child must be able to remove himself from direct supervision.
2. When removed from direct supervision the child should be observed but not governed in his activities.
3. When removed from direct supervision the child must have access to and be near to supervised activity.

Although the above form of solution statements was the most common, some students wrote paragraphs which included the above type of statement and pointed out some of the contradictions between them that would have to be resolved in the diagrammatic development of form relationships. Others attempted verbal descriptions of possible form relationships necessary to realize their solution statements.

Form Solutions and Diagramming:

The development of the actual form solutions and diagrams for the subsystems was by far the most time-consuming and difficult part of the entire process. Ideally, the "diagram must be so specific that it has all the physical characteristics called for by the requirements of the sub-set, yet it must be so general that it contains no arbitrary characteristics, and so summarizes, abstractly, the nature of every form which might satisfy the subset." (Notes, page 127) The realization of diagrams of this nature was, however, hindered by a number of problems, most of which will have to be resolved if this approach to design is to achieve the economy necessary to make it practical.

Initially many diagrams were developed which, instead of indicating physical form relationships, were vague representations of the solution statements. When pressed to develop a set of the necessary physical form relationships, the tendency was to over-solve (or in some cases undersolve) the subsystems.

In over-solving a subsystem, information from other subsystems was introduced, or subsystems were solved at a more fine-grained level than was justified by the requirements; or more spatial relationships were specified than were justified by the requirements in the subsystems. Frequently this attempt at making a concrete or specific solution was based on a desire to make the diagrams as much like architectural floor plans as possible. This was unfortunate, because the entire idea behind diagramming is to produce a statement of only those elements of a form solution which will be invariant in the realization of any number of specific buildings. Thus many elements of the form solution, if compared with the typical architectural floor plan, will be indeterminant. This indeterminacy of the conceptual solution or its diagrammatic symbolization is a result of the small number of requirements contained in a subsystem and the fact that requirements are not in a subsystem because they completely specify some spatial element of the problem, but because the form relationships necessary to satisfy the requirements strongly conflict with or strongly compliment one another.

Requirements were not written with the understanding that the misfits they were derived from applied to every single element of the problem (as, for example, would the requirement "make everything as economical as possible"). Instead, they were written with the intention of describing the greatest number of mutually constraining misfits that would lead to the major elements and relationships in the physical form. Consequently, solving this set of misfits did not completely define the physical form, as would detailed considerations of material, structure, economy, etc. Learning to deal only with this set of relationships was one of the most difficult tasks the class faced.

The introduction of new information into the solution of a subsystem was not always based on a desire to specify a completely determined form. In many cases it was an attempt to solve those related potential misfits that had not been described as force-tendency statements. For example, the changes in the needs of the blind child as he develops both socially and perceptually had been very poorly described. Introducing information about the child's development often radically changed the form implications of the interacted requirements.

Another form of information introduced into the development of diagrammatic solutions was the "derived misfit". These can result from considering the impact of undescribed parts of the context on the proposed form solution. For example, the problems a blind child would encounter in relation to an automobile were only partially and indirectly described. It was argued that since the automobile will not be redesigned by the architect, it should be considered a stable part of the context and should therefore be considered at the diagrammatic stage even though its misfits were undescribed. Another type of "derived misfit" would be one which appears as a problem in the proposed form solution but which is actually explicitly stated as a requirement in another subsystem. Attempting to solve for this type of misfit within the subsystem destroys the "relative independence" of the subsystem and the control over the subsequent combinations.

The diagrammatic results of having an incompletely described context, and of dealing with derived misfits were varied. Some form solutions never deviated from the original set of requirements and their strict interpretations, while other form solutions introduced so much new information that they were on the verge of becoming diagrams of a very large, but little understood, part of the problem. Much work remains to be done on how to deal with new information resulting from an incompletely described context, and derived misfits.

It is very important to arrive at a form solution for as much of the subsystem as possible before preceeding to the next level of combination. There was a temptation on the part of many class members to consider some of their requirements and resulting solution statements too general and undetermined to diagram until they were combined with other subsystems at a higher level of combination. The danger in not determining all the necessary form relationships within the subsystem is that the form solution becomes such a strong statement relative to any miscellaneous verbal statements that upon combination the verbal statements are frequently lost.

Combination of Subsystems:

The combination of form solutions at the first level should proceed as follows. First, the rejoined interactions between the two or more subsystems to be combined are examined and solution statements are developed. Depending upon the number of interactions cut and their grouping, examination of the total set of interactions within and between the two or more subsystems may reveal a relatively tight and independent cluster of interactions that could be considered as a new independent subsystem. In most cases the number of rejoined links is either too small or too random to deserve a separate attempt at diagramming. Time can be saved in developing the rejoined interactions by checking to see if the form inplications are the same as those previously developed in one or more of the subsystems.

Once the rejoined links have been developed, the subsystems should then be ready to combine. However, at this point in the class procedure a new set of problems arose. Because each student had developed separate diagrammatic forms with meanings only he understood, a long period of verbal explanation of the subsystems was required for effective communication of the form solution. Also, some form solutions consisted, in part, of organizational solutions where physical form and scheduling, for example, were solved in a complimentary relationship. These organizational decisions and their relevancy to the diagrams also required verbal explanation.

In the verbal explanation many fine points which had been considered in developing the form solution were over-looked and often varying degrees of development of the physical form caused some problems as did the necessity for each individual to explain what relationships on the diagram were a result of chance occurance of an unspecified diagrammatic relationship.

At this point many students wondered if a form solution should be diagrammed at all. The rebuttal was that diagrams are the only way available to indicate many physical relationships and configurations for which there exist no verbal concepts, and that the development of the diagram reveals many more internal problems than is possible with verbal description. A diagrammatic language which is both unequivocal in its power to communicate, and yet flexible enough to capture any conceptual physical situation was definitely needed. Such a language must also be able to specify the limits on the range of possible physical forms that could be used to solve a given physical form relationship.

Many disagreements at the first level of combination were based on legitimate conflicts between conflicting requirements and interactions in different subsystems, but not all conflicts were of this nature. In some cases, for example, knowledge about a certain child developmental need was required to adequately solve a problem in the subsystem. Not having exact information, assumptions would be made and decisions would be based on these assumptions. In many cases students attempting to combine form solutions had made different assumptions about the same situation. Though these were usually resolved as the conflict became apparent, many conflicting assumptions remained implicit until future combinations when they became extremely difficult to resolve. Thus there appeared to be a need for a structure which would facilitate the recording of assumptions for easy identification and verification at a later date if necessary.

As the combination of subsystems progressed, the form solutions began to have a consistant range of physical scale. Initially, many small scale relationships were included, such as the relationship of objects to their use area. These relationships were overlooked in many combinations. This was the result of a number of situations. One was the great differences in scale contained in the form solutions and the questionable attempt to produce one large diagram without unrelated loose ends. Another was the concern with solving the most tightly restrictive and complex set of relationships (most often those of the larger physical scale) which made the smaller scale relationships seem unimportant.

In addition to problems inherent in combining the form solutions, other elements tended to push the solution to a relatively consistant range of physical scale. One of these was the fact that most of our information could be characterized as dealing with the problems of the individual relative to other individuals and to groups. Those requirements which did potentially imply person-to-object relationships on a small scale, were based on an incomplete understanding of the perceptual problems of the blind and consequently were often neglected.

Finally there was the reluctance to specify any objects or equipment by name, even though social roles such as teacher and therapist were identified by name and accepted as stable elements in the problem. It might have proven helpful to decide at the outset which objects were extremely likely to occur in even the most complete innovation. For example, in this problem, the design of objects to meet the needs filled by tape decks and braille writers was certainly beyond the range of solutions to be attempted by this class, and their potential misfits might have been more explicitly included in the requirements.

As the combinations at the higher levels of the hierarchy are reached it becomes extremely difficult to solve for any new implications resulting from rejoined links, for the more developed the form solutions become the more difficult it is for a few new interactions to have a significant effect. This presents no problem if the majority of the interactions are intact at the lower levels of the hierarchy. For example, the percentage of interactions present at each level of the hierarchy in this problem were:

66%	initial subsystems
81%	1st combination
98%	2nd combination
100%	3rd combination

Consequently, at the final level of combination, the problems which arose were not the result of attempting to integrate new interactions into the solution. They were, instead, similar to those difficulties encountered at the earlier levels of combination, but intensified. Each group involved in the last combination considered its part of the form solution to be sound, and were extremely reluctant to change either its interpretation of interactions or its assumptions about the needs of the developing child. Revising interpretations or assumptions would have forced revision of much of each form solution, an impossible task in the time allowed, since it would have required reworking a large number of the lower-level subsystems and combinations.

FINAL FORM SOLUTION

FINAL FORM SOLUTION

The diagram following this discussion is an abstraction of the final form solution. It shows all necessary physical relationships but shows neither the size of each space nor the precise number of formal areas. It should not be interpreted as a floor plan, but as a graphic symbolization of the required physical organization of the school. The accompanying text is a simplified explanation of the final form diagram. Detailed explanations of the final form solution, and those subsystems and combinations that led to it, appear in Appendix C.

The major organizational structure is reflected in differences between the compact structure at the top of the diagram and the clustering at the middle. These are a result of the basically different activities which occur in each area. The top area contain children whose problems are so severe or whose learning is at such a low level that they need continuous, closely supervised, highly structured directions. In the bottom area are those children who can successfully learn in a more complex environment which requires the ability to make decisions. Between these physical and developmental extremes are children who have gained some competance in moving about but who still require supervision in their activities.

In the intensive care area at the top are the very young children, the mentally retarded, multiply-handicapped and hyperactive. The areas and the connections between them are simple, small and direct. These conditions provide the children an environment which is equivalent in complexity to their abilities. At the same time, continual personal supervision by the staff complements the spatial structuring and assures that s child will make transitions into the more complex environments when he is prepared. The essential conditions for these children are first, a stable, comprehensible environment in which they can operate successfully and second, competent staff to help the learning process through teaching and therapy. The number of areas and children can vary in number so long as these conditions remain.

Gradually, according to each child's capability, he will participate in activities which require more self control and ability to understand more complex intellectual and spatial relationships. He will be allowed more freedom to act independently in his movements through the school and into therapy and activity areas, but will still be supervised within the activities and in his access to the external world. This minimal control in a flexible spatial environment will permit an unpressured development which could even tolerate temporary regressions.

The children's needs establish the intensive-care and upper level activity areas with organizational gradations between. Generally, in the intensive-care area the children tend to remain in one class space and the activities change within the class as compared to the more advanced areas where an activity tends to remain in one class space and the children move between them.

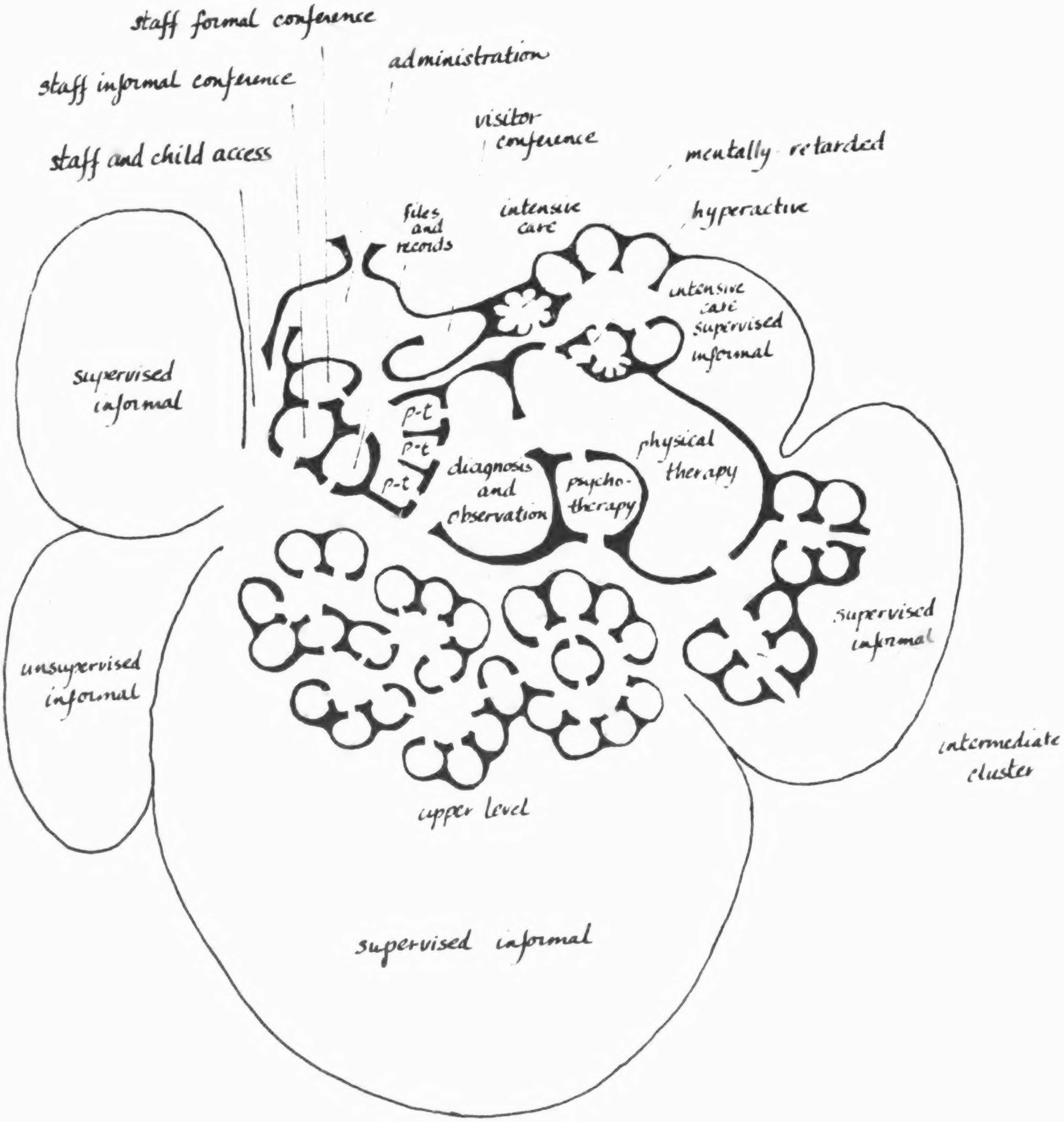
In the intensive-care area the activity areas or classrooms are small and simple in terms of the number and complexity of cues and stimuli. Individual work areas removed from the group activity area provide teaching flexibility by eliminating distractions between the group and the individual when necessary. Storage for both teacher and student's use is readily accessible and controllable. The class area is immediately adjacent to the circulation areas and a closely supervised play area with access requlated by the class teacher. The upper level class area contains both supervised and independent activities, with more complexity introduced by the arrangement of objects, more access points and a less static ordering of these elements.

Circulation within the upper area reflects the increase in complexity. The cluster arrangement of the intermediate or transitional level remains in the upper level, but the paths a child may take between formal activity locations vary according to his ability to master them, to his choice of direction or to scheduling considerations.

The therapy, diagnosis and observation areas are primarily for treating children, but serve their parents as well for diagnostic procedures. The therapy area is divided into facilities for physical and psychotherapy, both relating to intensive care and to intermediate and upper levels.

Related to therapy and instruction areas are the areas for informal activity or play, since a child is often more amendable to learning after an informal activity. The informal areas range progressively from a closely observed and separate area primarily for the use of intensive-care children to unsupervised and freely accessible areas, available to the upper level child. Children of different academic levels can intermix within them, as an aid to their social development.

The administrative complex contains areas for an administrative staff, visitor conferences, parent-staff conferences, both formal and informal staff conferences, and files and records. The administration area controls public access to the school while children and staff have a special access (to the left of the administrative area in the diagram). The administrator, authorized personnel and, to a limited extent, parents may pass from the parent-staff conference area to the intensive-care area. Parents are directed from the administrative area to the parent-staff conference areas where matters from routine paper-work to psychiatric consultation can be handled. These areas also function with diagnosis and observation, at the time of the school's initial contact with the child and throughout his education and treatment. Both formal and informal staff conference areas function for discussions, class preparations and relaxation; the formal area implies discussions of a more serious nature or ones which could be misinterpreted by the children. The entire administrative complex has easy access to the area for files and records, where complete information on each child is kept.


staff formal conference
administration
staff informal conference
visitor conference
staff and child access
mentally retarded
files and records
intensive care
hyperactive
intensive care supervised informal
supervised informal
p-t
p-t
p-t
diagnosis and observation
psycho-therapy
physical therapy
supervised informal
unsupervised informal
intermediate cluster
upper level
supervised informal

SUMMARY

SUMMARY

This summary will be of a review of some of the major solved and unsolved problems inherent in this approach to design, including some suggestions for improvement and tests of the validity of parts of the theory.

Research:

Desperately needed is a model for producing architecturally relevant information in such a form that the designer, who has no personal exposure to the problems in a proposed project area, will be able to successfully solve its problems free of preconceived architectural concepts. The model will, no doubt, include something akin to the force-tendency statements derived from the observations of misfits. But since the designer will lack any sense of the "fits" in the problem, or of those invariant elements which are beyond the realm of forms the designer can manipulate, this information must be provided to him in useful form. The need for such a model became evident in a class of this size where different individuals experienced different parts of the context.

Operational definition of a conceptual solution:

The researcher, the requirement writer, and the diagrammer, all need an operational definition of what constitutes a conceptual solution. The researcher needs it so he will know when he is receiving relevant information. The requirement writer needs it so he can better tell if his force-tendency statements are being written both at a level and in problem areas which are useful. The diagrammer needs a better sense of what constitutes a conceptual solution so he can better focus on solving the problems of basic form relationships without being distracted in an attempt to resolve the indeterminacy in his form solution.

Binary interactions as a method of structuring a complex problem:

There is little doubt surrounding the worth of carefully considering small groups of interacting requirements in depth in an attempt to solve the conflicts between them. However, there is some doubt about the ability of the binary interaction method, followed by a computer decomposition and structuring, to produce a structure any more coherent or free from pre-conceptions than would a group who intuitively classified a set of requirements. The group doing the binary interactions based their interactions on an intuitive notion of what can and cannot be solved by the use of physical form. How strongly their preconceptions about the structure of the problem influenced the structure which emerged after these binary interactions is open to conjecture. Binary interaction, as a structuring technique, only begins to be superior to intuitive classification when applied to a very complex problem. For these reasons and since binary interactions are very time-consuming and often boring, their validity in structuring the problem needs testing. Such a test could be conducted as outlined below. However, a more rigorous set of controls would have to be employed than those few suggested.

Problems of varying complexity would be researched by a large group of people, with information and insights freely exchanged. Part of the group would consist of individual's familiar in use of the binary interaction method of problem structuring; the other part would be a number of designers well-versed in intuitive problem structuring. A group of requirements acceptable to both groups would be written.

As the problem structuring stage was reached, the intuitive structurers would be placed in one group while the binary interacters would be placed in another or the individuals would be assigned to one of the two structuring groups by random selection. One group would do a binary interaction while the other group would structure the problem intuitively, using any method desired except binary interactions, and their approach would be recorded.

The results would be compared. If both structures were basically the same, doubts would be cast upon the binary interaction approach, at least for problems of that size. If they differed they should be studied to see if the development of the intuitive structure mirrored existing solutions more than the one developed by binary interactions. (All of this, of course, does not solve the issue of which approach is more valid in terms of the quality of the solution.)

Physical and symbolic structures for group development of a design project:
Throughout the year it became increasingly evident that the class needed a better physical environment in which to achieve some efficiency in working as a group. Initially, a noisy drafting room was provided in which continual, serious, uninterrupted action took place in groups ranging from two members up to the entire class. The response to this environment was immediate. Group members found unused rooms and corners scattered all over the building, university, and environs, in which to do their work. This resulted in a tremendous inefficiency in the movement of materials and equipment and in the communication between group members. Typewriters, tape recorders, a telephone, and a duplicating machine were necessary 24 hours a day. A proposed solution(which was eventually approximated) would be a series of rooms of various sizes in close proximity to one another sharing a bull pen for the exclusive use of the group and containing the above equipment. Any group attempting a team effort such as this one is advised to provide such space, even if it must be at their own expense.

Also needed are various methods to reduce the amount of information loss which occurs when a group works together on a complex problem. This information loss was created in part by the lack of explicit reporting of misfits during the research phase, and the failure to include misfits as an addendum to the various force-tendency statements written from them. Information loss was further increased by the tendency not to record assumptions and new information introduced in the development of the form solutions. These faults were accentuated by the ineffectiveness of diagrams as a communication tool.

An architect presented with the final form solution diagram might be able to begin to grasp its significance, but without a detailed and time-consuming review of the entire set of developmental material, the subtleties would be lost and erroneous relational information, inadvertently generated, would be confusing. Any advance in making diagrams more explicit and less subject to conveying erroneous information would be a major contribution to those interested in developing communicable conceptual solutions.

APPENDIX A: REQUIREMENTS AND INTERACTIONS

REQUIREMENTS:	INTERACTIONS:
1. When unable to determine his location by familiar reference points, a blind child will be insecure in his movements.	3, 4, 5, 6, 7, 10, 11, 12, 13, 15, 17, 18, 22, 24, 25, 26, 30, 40, 43, 46, 47, 56, 62, 65.
2. Parents who don't know how their child is developing in school will often retard this development with inconsistent training.	7, 15, 39, 44, 53, 55, 59, 60, 61, 64, 66, 67, 68, 69, 70,71, 75, 76, 78, 79, 84, 86, 87.
3. A blind child's dependence on physical contact for locating and identifying objects often results in injury when the objects are confronted unexpectedly.	1, 4, 5, 7, 10, 12, 13, 15, 18, 21, 31, 38, 43, 46, 52, 56, 57, 74.
4. Because a blind child mentally notes a specific location for an object he frequently uses or encounters, he becomes confused if he finds the object has been moved or a different object is in that location.	1, 3, 5, 6, 7, 10, 12, 13, 15, 30, 38, 40, 43, 47, 54, 56, 62, 65, 74.
5. Because a blind child explores his environment actively, through touch, he often feels insecure in his movements when that environment is unfamiliar.	1, 3, 4, 6, 7, 10, 11, 12, 13, 15, 18, 21, 25, 30, 40, 43, 51, 54, 56, 62.
6. Because a blind child must concentrate, mentally and physically, in order to cope with his immediate environment, he is often fatigued by physical tasks.	1, 4, 5, 8, 9, 10, 12, 15, 16, 17, 21, 23, 24, 30, 35, 43, 47, 50, 51, 54, 74, 81.
7. When a blind child knows his activities are continually supervised, he does not develop self-reliance.	1, 2, 3, 4, 5, 8, 9, 12, 19,21, 23, 26, 31, 39, 47, 53, 60, 62, 63, 66, 79, 85, 89, 90, 91.
8. If a blind child cannot get help from the teacher when he needs it, he may disturb people around him by asking them for assistance.	6, 7, 9, 11, 14, 16, 17, 18, 19, 33, 36, 39, 41, 53, 59, 75, 80, 83, 85.
9. When a teacher instructing a group of blind children must devote his attention to a single student, the other students will waste time for lack of direction.	6, 7, 8, 36, 39, 47, 53, 58, 59, 60, 63, 66, 73, 77, 89.

10. Objects with similar forms and physical properties but different in purpose or intent are confusing to a blind child.	1, 3, 4, 5, 6, 13, 15, 21, 24, 29, 46, 49, 51, 54, 62, 74.
11. If a blind child receives no sound cues from his surroundings he will rely on self-generated noises to establish his position in space.	1, 5, 8, 12, 14, 15, 17,19.
12. When a blind child's practice in mobility and orientation is restricted to a known environment, he becomes confused and insecure in a new or changing environment.	1, 3, 4, 5, 6, 7, 11, 13, 21, 24, 25, 26, 28, 29, 34, 35, 38, 40, 43, 47, 51, 56, 62, 72, 77.
13. By mistaking a moveable object for a stable one, a blind child can misorient himself if he determines his location relative to that object.	1, 3, 4, 5, 10, 12, 18, 22, 26, 36, 46, 62.
14. Sounds which are not part of a background noise level will interrupt a student's concentration on his individual study.	8, 11, 16, 17, 19, 20, 23, 28, 61, 71.
15. Objects without a unique characteristic are difficult for a blind child to remember.	1, 2, 3, 4, 5, 6, 10, 11, 18, 24, 30, 36, 46, 54.
16. A blind child's communicating with others often interferes with their individual study.	6, 8, 14, 17, 19, 23, 27, 33, 57, 58, 61, 83.
17. The introduction of sounds irrelevant to an activity will confuse a blind child if he is dependent on the sounds of the activity to guide his participation.	1, 6, 8, 11, 14, 16, 19, 28, 36, 40, 46, 57, 58, 61, 62, 65, 86, 88.
18. Because a blind child initially perceives objects as obstacles, harsh contact with them inhibits his desire to become mobile.	1, 3, 5, 8, 13, 15, 21, 34, 52, 54, 56, 57.
19. When instructions concerning an activity are not received clearly, a blind child's reaction is often non-participation rather than confused participation.	7, 8, 11, 14, 16, 17, 21, 23, 25, 27, 30, 33, 60, 65.
20. Lacking any external cues, a blind child will disorient himself if he cannot measure his movement over time.	14.

21.	A blind child's lack of curiosity to explore his environment will impede his progress in achieving coordination and control over his bodily movements.	3, 5, 6, 7, 10, 12, 18, 19, 23, 24, 29, 37, 44, 57, 63, 77, 89, 91.
22.	Marked transition periods between class activities require additional time to regain the student's attention.	1, 13, 25, 29, 34, 42, 46, 57, 74, 80, 90.
23.	Because a child's attention easily dwindles in a prolonged activity, he often becomes restless and seeks diversions.	6, 7, 14, 16, 19, 21, 27, 29, 35, 36, 37, 39, 42, 51, 54,57, 58, 63, 65, 73, 82, 85, 91.
24.	Objects without familiar qualities are difficult for a blind child to identify and use.	1, 6, 10, 12, 15, 21, 40, 45, 56, 74.
25.	Because a blind child fears injury to himself or others, he is hesitant in moving through unfamiliar surroundings.	1, 5, 12, 19, 22, 26, 31, 38, 43, 44, 52, 56, 58, 82.
26.	Confusion and insecurity in an unfamiliar environment often inhibit a blind child from seeking aid.	1, 7, 12, 13, 25, 34, 38, 40, 43, 46, 47, 54, 62.
27.	If other children are outside immediate reach, a blind child has difficulty establishing and maintaining communication and social interaction.	16, 19, 23, 32, 33, 35, 37, 39, 48, 58, 65, 83, 88.
28.	Because a blind child cannot visually identify a sound with its source, unfamiliar noises which are loud or harsh tend to frighten him.	12, 14, 17, 46, 56.
29.	When a change in activities necessitates a change in location, the time spent moving is often non-productive.	10, 12, 21, 22, 23, 40, 42, 44, 47, 50, 66, 72, 74, 80, 82, 85, 89.
30.	A blind child's difficulty in pin-pointing the locations of objects not in use hampers his ability to find objects outside immediate reach when they are needed.	1, 4, 5, 6, 15, 19, 33, 40, 45, 46, 47, 54, 57, 65, 74.
31.	Attempts to ensure a blind child's safety by means of close supervision infringe upon his privacy.	3, 7, 25, 34, 35, 38, 46, 47, 53, 56, 58, 59, 62, 66, 71, 85, 89.

32.	When they must compete with sighted children in visually-oriented activities, blind children feel inferior and frustrated.	27, 34, 48, 59, 66, 83.
33.	Non-academic movement and talking by blind students hamper a teacher's control of a class.	8, 16, 19, 27, 30, 39, 41, 42, 44, 53, 57, 58, 61, 68, 88, 90, 91.
34.	If a blind child is made to feel dependent on either mobility aids or on patronizing people, he may develop a defeatist attitude about his becoming self-reliant.	12, 18, 22, 26, 31, 32, 38, 43, 47, 49, 50, 52, 53, 56, 59, 63, 72, 76, 79, 85, 87.
35.	Because he cannot visually observe the physical actions of others, each blind child must experience these activities in order to understand them.	6, 12, 23, 27, 31, 36, 38, 44, 51, 57, 58, 89.
36.	When physical involvement does not accompany a verbal description of a physical organization or process, a blind child's conceptual image of the process or organization is often distorted or incomplete.	8, 9, 13, 15, 17, 23, 35, 38, 48, 56, 65, 72, 73, 74, 89.
37.	Because his environmental stimulation is intermittent, a blind child may seek self-stimulation through physical mannerisms or through withdrawal into phantasy worlds.	9, 21, 23, 27, 55, 63, 64, 85, 89.
38.	If a blind child is not allowed to gain experience outside his customary environment, his dependence on that environment is increased.	3, 4, 12, 25, 26, 31, 34,35, 36, 40, 43, 47, 51, 53, 56,59, 66, 72, 79, 83, 84, 89.
39.	If a blind child feels that he can escape punishment, he may disrupt activities through lack of self-control.	2, 7, 8, 9, 23, 27, 33, 41, 53, 57, 73, 89, 90.
40.	When a blind child must concentrate on his immediate environment and destination, simultaneous participation in another activity is difficult.	1, 4, 5, 12, 17, 24, 26, 29, 30, 38, 43, 51.
41.	When a blind child feels that other children are receiving attention rightfully his, he often becomes demanding or hostile.	8, 33, 39, 45, 59, 73, 82, 88.

42. If children are forced into a new activity before their interest in another activity is exhausted, they will often resist starting the new one.	22, 23, 29, 33, 60, 65, 73, 80, 82, 90.
43. If a blind child's environment is significantly altered, he adjusts to the change in a fragmentary--rather than gradual, comprehensive--manner.	1, 3, 4, 5, 6, 12, 25, 26, 34, 38, 40, 46, 51, 52, 54, 56, 79.
44. If a blind child with undeveloped muscular coordination is denied constructive opportunities for physical exercise, he will not learn to restrain his uncontrolled movement.	2, 21, 25, 29, 33, 35, 46, 48, 51, 52, 53, 57, 58, 64, 77, 82, 89.
45. If a child is denied individual control over things he feels are his, he often develops a possessive attitude toward the property of others.	24, 30, 41, 54, 74.
46. Because hyperactive children are often unable to discern pertinent stimuli, either they fail to react to important stimuli or they react to all stimuli equally.	1, 3, 10, 13, 15, 17, 22, 26, 28, 30, 31, 43, 44, 49, 52, 53, 54, 56, 57, 65, 77.
47. If a child is denied opportunities to make simple choices, he is hesitant to act when faced with decisions.	1, 4, 6, 7, 9, 12, 26, 29, 30, 31, 34, 38, 51, 52, 53, 62, 83.
48. The anti-social attitude of most emotionally-disturbed children will cause them to withdraw from any form of group participation.	27, 32, 36, 44, 53, 55, 65, 66, 73, 75, 83, 85, 88.
49. If a partially-sighted child's vision is limited by external forces, neither he nor others can rely on his visual recognition and/or interpretation for guidance.	10, 34, 46, 50, 52, 62, 72.
50. If the handicapped child is not encouraged to develop his limited faculties, their usefulness will deteriorate.	6, 29, 34, 49, 64, 66, 72, 73, 74, 77, 83, 85, 89, 91.
51. If a blind child is compelled to learn or react at a rate not suited to his abilities, he will become inattentive or resistive.	5,6, 10, 12, 23, 35, 38, 40, 43, 44, 47, 54, 55, 56, 57, 60, 63, 64, 66, 73, 82, 89, 90.

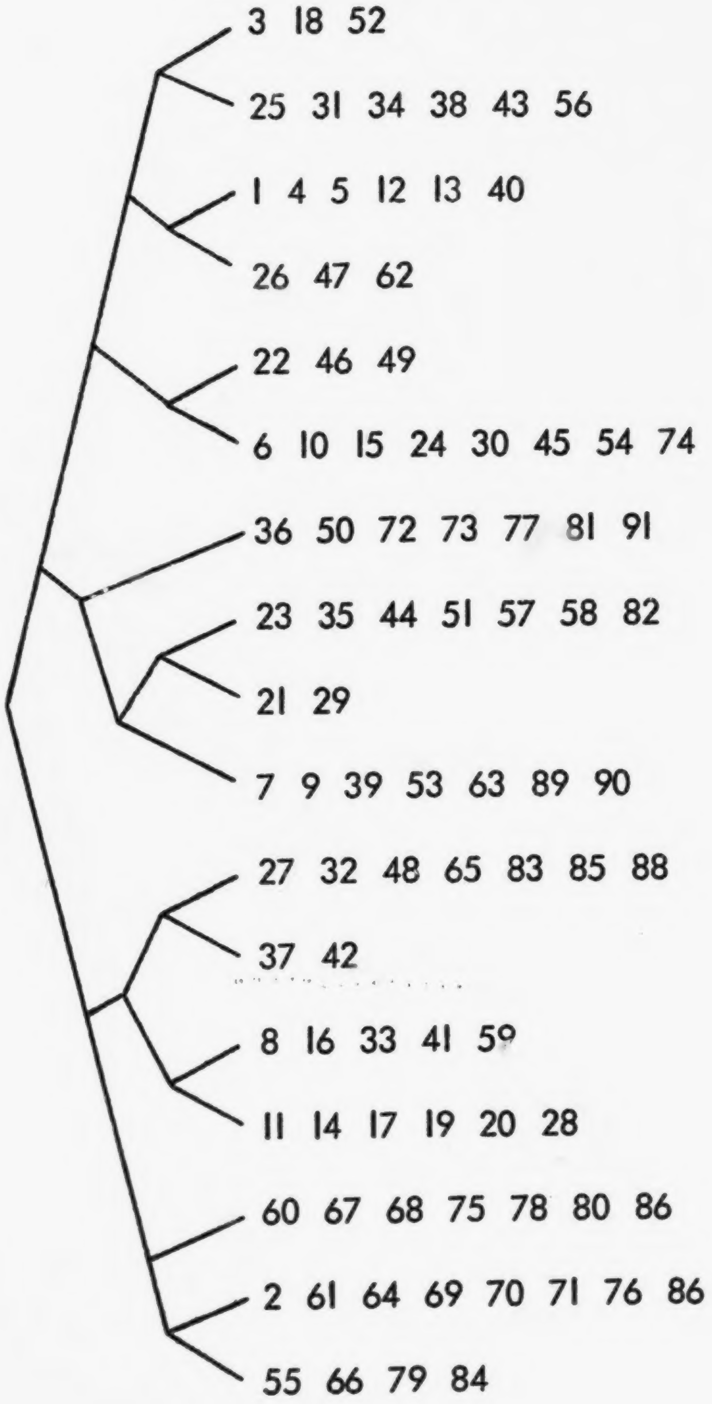
52. If a mentally-handicapped blind child does not sense physical danger, he can easily injure himself through his uninhibited movement.	3, 18, 25, 34, 43, 44, 46, 47, 49, 53, 54, 56, 58, 82.
53. Excessive supervision of an activity provokes a blind child into reacting against the supervision rather than responding to the activity.	2, 7, 8, 9, 31, 33, 34, 38, 39, 44, 46, 47, 48, 52, 56, 57, 58, 63, 65, 75, 82,89,90.
54. If a blind child must explore an object or situation at length in order to identify it, his reaction to it is often delayed.	4, 5, 6, 10, 15, 18, 23, 26, 30, 43, 45, 46, 51, 52, 56, 74.
55. When therapy or remedial education is piecemeal or discontinuous, the regressive tendencies of the mentally-handicapped blind child are unrestrained.	2, 37, 48, 51, 65, 68, 69, 73, 84.
56. Since a blind child's fragmented perception -- of parts rather than wholes --does not show him immediately which parts are potentially dangerous, he will hesitate to explore an unfamiliar environment.	1, 3, 4, 5, 12, 18, 24, 25, 28, 31, 34, 36, 38, 43, 46, 51, 52, 53, 54, 72, 89.
57. Because a hyperactive child releases his energy vigorously, limiting his actions will frustrate him.	3, 16, 17, 18, 21, 22, 23, 30, 33, 35, 39, 44, 46, 51, 53, 58, 65, 68, 82.
58. Because a hyperactive child often releases his excess energy without regard to its effects, he disrupts his own or others' academic tasks.	9, 16, 17, 23, 25, 27, 31, 33, 35, 44, 52, 53, 57, 74, 82, 83.
59. When a blind child's needs and desires are catered to preferentially, others around him will often become jealous and/or condescending.	2, 8, 9, 31, 32, 34, 38, 41, 63, 73, 76, 89, 90.
60. If teacher-therapists do not know how a child is applying what has been taught, they have no way to assess his progress or potential.	2, 7, 9, 19, 42, 51, 61, 63, 67, 68, 69, 70, 71, 75, 80, 84, 89, 91.
61. Because most visitors are inquisitive, their presence often disrupts the educational processes.	2, 14, 16, 17, 33, 60, 64, 66, 69, 70, 71, 76, 84, 86.
62. If a blind child loses his way, he often does not know where or how he erred.	1, 4, 5, 7, 10, 12, 13, 17, 26, 31, 47, 49.

63.	When working at a level which produces no sence of accomplishment, a child will seek a level where he can succeed.	7, 9, 21, 23, 34, 37, 51, 53, 59, 60, 90, 91.
64.	Observing manifestations of blindness which appear abnormal to him may reinforce a sighted person's discriminatory tendencies and/or prejudices about the blind.	2, 37, 44, 50, 51, 61, 66, 70, 71, 83, 86.
65.	When a teacher-therapist must devote time merely to keeping track of students, his instruction will be sporadic.	1, 4, 17, 19, 23, 27, 30, 36, 42, 46, 48, 53, 55, 57, 85, 88, 90.
66.	If a child's communication with people is limited to a fixed group, his motivation and social development will be retarded.	2, 7, 9, 29, 31, 32, 38, 48, 50, 51, 61, 64, 79, 83, 84, 85.
67.	If an administrator is not familiar with the functioning of an educational program, he cannot evaluate its effectiveness.	2, 60, 68, 70, 86, 87.
68.	If teachers and therapists are not familiar with a blind child's additional handicaps, they may aggravate those handicaps through incorrect training.	2, 33, 55, 57, 60, 67, 69, 78, 87.
69.	If parents do not understand the procedure for their child's diagnosis, they may neither accept the diagnosis nor support the prescribed therapy.	2, 55, 60, 61, 68, 70, 84, 86, 87.
70.	If a child discovers his problems being discussed by others, his subsequent actions in their presence may become inhibited or hostile.	2, 60, 61, 64, 67, 69, 71, 76, 80.
71.	If a blind child realizes his actions and reactions are being observed and evaluated, he often feels he must exaggerate his behavior.	2, 14, 31, 60, 61, 64, 70, 81, 86, 89.
72.	If a child can discern no practical application for what is being taught, he will lose interest in it.	12, 29, 34, 36, 38, 49, 50, 56, 74, 89, 91.
73.	If children are not grouped for educational instruction according to level of academic achievement, teachers must adjust content and method of instruction to suit each child's academic abilities.	9, 23 36, 39, 41, 42, 48, 50, 51, 55, 59, 74.

74. If materials or movement necessary to effect an activity cannot be applied without disruption or delay, teacher-therapists often disallow the activity.	3, 4, 6, 10, 22, 24, 29, 30, 36, 45, 50, 54, 58, 72, 73, 78, 81.
75. If a child feels that his contact with teacher-therapists is limited to structured activities, he will hesitate to seek their advice outside those activities.	2, 8, 48, 53, 60, 76, 80, 84, 89.
76. If a child does not feel that aid he is seeking and receiving will remain confidential, he may neglect to seek aid for fear of social stigma.	2, 34, 59, 61, 70, 75, 79, 85.
77. Because mentally-retarded children are usually indifferent to their surroundings, it is difficult to actuate them either mentally or physically.	9, 12, 21, 44, 46, 50, 89.
78. If those responsible for a child's education do not know about innovative techniques or lack the opportunity to apply them, a handicapped child may receive inadequate care.	2, 68, 74, 84, 87.
79. If a child's progress requires that he break contact with those who have been helping him, adjusting to their absence may retard his further development.	2, 7, 34, 38, 43, 66, 76, 84, 85, 86.
80. If a teacher-therapist is denied occasional diversions from his work, his physical and/or emotional exhaustion will make him less effective in his work.	8, 22, 29, 42, 60, 70, 75.
81. Because a blind child's study equipment and materials are bulky and unwieldy, he may be discouraged from using them.	6, 71, 74, 82.
82. Without outlets for physical energy, children will willfully damage or destroy objects in order to vent their frustrations.	23, 25, 29, 41, 42, 44, 51, 52, 53, 57, 58, 81.
83. If a child is isolated from his peers, he may become aggressive or introverted, hindering his participation in groups.	8, 16, 27, 32, 38, 47, 48, 50, 58, 64, 66, 85, 88, 89.

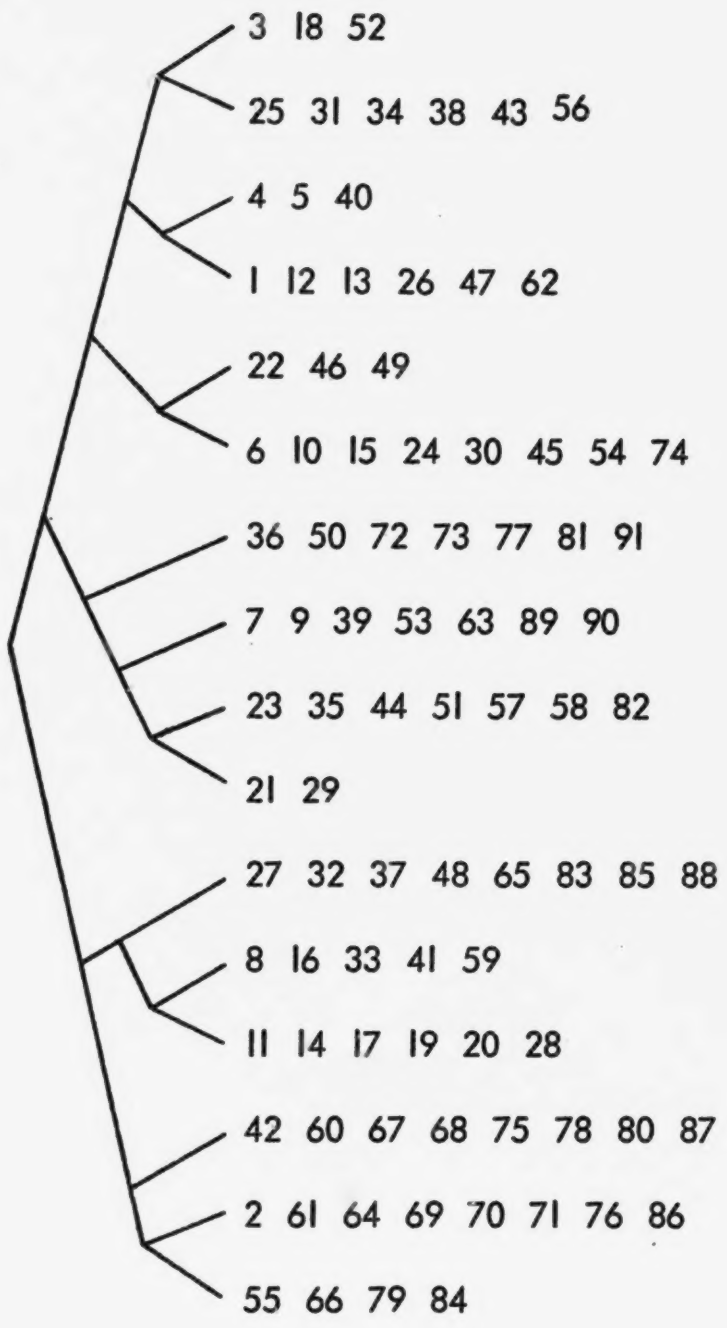
84.	If a parent's role in his child's development is being usurped, he will neither cooperate with those who are usurping his role nor support their program.	2, 38, 55, 60, 61, 66, 69, 75, 78, 79, 86.
85.	When a child's activities are limited to group participation, his individual initiative is often repressed.	7, 8, 23, 29, 31, 34, 37, 48, 50, 65, 66, 76, 79, 83, 88, 89, 91.
86.	If visitors are given a distorted or incomplete image of the educational program, the constructive value of their presence is questionable.	2, 17, 61, 64, 67, 69, 71, 79, 84.
87.	If the evaluation of an educational program is done exclusively by those directly participating in its development and application, their limited perspective may retard advantageous revision.	2, 34, 67, 68, 69, 78.
88.	Because a blind child in a group activity has difficulty identifying himself as a member of the group, his participation is often sporadic.	17, 27, 33, 41, 48, 65, 83, 85.
89.	If a child's "free-time" is completely unstructured or unsupervised, he often lacks the initiative to develop extra-curricular interests.	7, 9, 21, 29, 31, 35, 36, 37, 38, 39, 44, 50, 51, 53, 56, 59, 60, 71, 72, 75, 77, 83, 85, 90.
90.	If a child cannot avoid an activity, he may disturb or disrupt it by his reluctance to participate.	7, 22, 33, 39, 42, 51, 53, 59, 63, 65, 89.
91.	When a child's accomplishments in an activity are not apparent, he loses interest in continuing it.	7, 21, 23, 33, 50, 60, 63, 72, 85.

APPENDIX B: DECOMPOSITION AND STRUCTURING


3 18 52
25 31 34 38 43 56
1 4 5 12 13 40
26 47 62
22 46 49
6 10 15 24 30 45 54 74
36 50 72 73 77 81 91
23 35 44 51 57 58 82
21 29
7 9 39 53 63 89 90
27 32 48 65 83 85 88
37 42
8 16 33 41 59
11 14 17 19 20 28
60 67 68 75 78 80 86
2 61 64 69 70 71 76 86
55 66 79 84

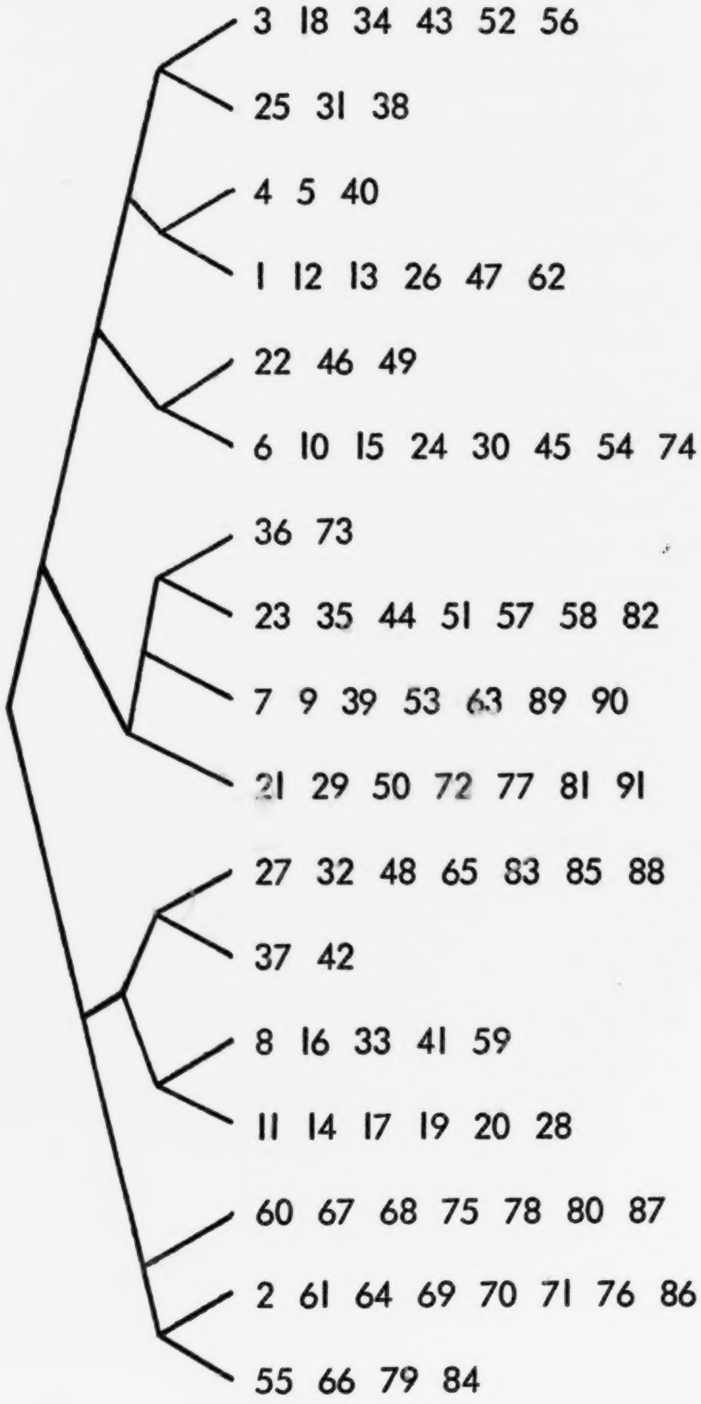
HIDEC DECOMPOSITION RESULT - LATTICE 20
The lattice number represents the number of times the split is attempted at any one partition. The "best" split encountered in the search is the one printed by the computer.

27% of interactions intact in subsets
36% of interactions intact in 1st combination
39% of interactions intact in 2nd combination
63% of interactions intact in 3rd combination
76% of interactions intact in 4th combination
100% of interactions intact in 5th combination


3 18 52
25 31 34 38 43 56
4 5 40
1 12 13 26 47 62
22 46 49
6 10 15 24 30 45 54 74
36 50 72 73 77 81 91
7 9 39 53 63 89 90
23 35 44 51 57 58 82
21 29
27 32 37 48 65 83 85 88
8 16 33 41 59
11 14 17 19 20 28
42 60 67 68 75 78 80 87
2 61 64 69 70 71 76 86
55 66 79 84

HIDEC DECOMPOSITION RESULT - LATTICE 24

25% of interactions intact in subsets
34% of interactions intact in 1st combination
37% of interactions intact in 2nd combination
65% of interactions intact in 3rd combination
78% of interactions intact in 4th combination
100% of interactions intact in 5th combination


3 18 34 43 52 56
25 31 38
4 5 40
1 12 13 26 47 62
22 46 49
6 10 15 24 30 45 54 74
36 73
23 35 44 51 57 58 82
7 9 39 53 63 89 90
21 29 50 72 77 81 91
27 32 48 65 83 85 88
37 42
8 16 33 41 59
11 14 17 19 20 28
60 67 68 75 78 80 87
2 61 64 69 70 71 76 86
55 66 79 84

HIDEC DECOMPOSITION RESULT - LATTICE 30

26% of interactions intact in subsets
37% of interactions intact in 1st combination
43% of interactions intact in 2nd combination
68% of interactions intact in 3rd combination
72% of interactions intact in 4th combination
100% of interactions intact in 5th combination

```
 1  3  4  5  6  7 10 12 13 15 26 30 38 40 43 46 47 51 54 56 62
 1  3  4  5  6  7 10 12 13 15 26 30 43 46 47 54 56 62
 1  3  4  5  6 10 12 13 15 18 30 43 46 54 56
 1  3  4  5  6  7 10 12 13 25 26 31 38 40 43 46 47 51 54 56 62
 1  3  4  5  6 10 12 15 24 30 40 43 46 51 54 56 74
 1  3  4  5  6  7 10 12 13 26 38 40 43 47 51 56 62
 1  3  4  5  6 10 12 15 24 30 38 40 43 46 51 54 56
 1  3  4  5  6 10 12 13 15 18 21 24 30 43 46 54 56
 1  3  4  5  6  7 10 12 13 15 18 26 43 46 54 56 62
 1  3  4  5  7 12 13 25 26 31 34 38 43 46 47 53 56 62
 1  3  4  5  6  7 10 12 13 21 26 43 47 62
 3 12 25 31 34 35 38 43 44 46 51 52 53 56 57 58 82 89
 7  9 12 31 34 38 47 51 53 56 59 63 89 90
 2 60 61 64 69 70 71 84 86
 7 12 29 31 34 38 47 50 51 53 56 66 72 83 85 89
 3 12 31 34 36 38 43 51 53 56 72 89
12 31 34 35 36 38 43 47 51 53 56 72 89
 2  7  8  9 39 53 59 60 63 89 90
 7  8  9 39 53 59 63 89 90
 8 14 16 17 19 23 27 33 39 53 57 58 65
 2  7 31 34 38 53 56 59 66 76 79 85 89
25 33 44 46 52 53 57 58 82
31 34 36 38 53 56 59 72 89
 7  8  9 19 21 23 33 39 53 60 63 89 90 91
 7  9 21 23 37 60 63 85 89 91
21 23 29 35 44 51 53 57 58 82 89
23 33 35 44 51 52 53 57 58 82
 7  8  9 23 36 39 53 73 85 89
 6  8 14 16 17 19 23 33 57 58
16 17 19 23 27 30 33 57 58 65
 7  9 21 39 44 53 63 77 89 90
27 32 48 65 66 83 85 88
12 21 29 44 50 72 77 89
29 36 50 72 73 74 89
29 34 50 72 74 85 89
23 27 35 36 48 51 55 65 73
```

HYPAP PROGRAM RESULTS
(listed in decreasing order of their relative internal density)

Five-way simplexes

```
 2 60 61 69 70      4  6 10 54 74     25 44 52 58 82
 2 60 61 69 84      4  6 30 54 74     44 52 53 58 82
 2 60 61 70 71      7  8  9 39 53     44 53 57 58 82
 2 61 64 70 71      7  9 39 53 89     34 44 53 57 58
 2 61 64 71 84      7 39 53 89 90     31 38 53 56 89
 2 61 69 84 86     12 34 53 89 90     36 38 56 72 89
```

Four-way simplexes

```
 2 68 69 87      27 48 65 88       1  4 30 65
 2 68 78 87      27 48 83 88       1 30 46 65
 2 60 67 68      27 32 48 83      30 46 57 65
 2 60 68 69      32 48 66 83      46 53 57 65
 2 55 68 69      48 83 85 88       1 13 22 46
 2 55 69 84      48 65 85 88      22 29 42 80
 2 61 70 76      48 66 83 88      21 29 44 89
 2 61 66 84       6 12 35 51      21 44 77 89
 2 61 64 66      12 35 38 51      21 23 37 63
 2 66 79 84      35 38 51 89       6 23 35 51
 2 79 84 86      31 35 38 89       7 19 21 23
 2  7 66 69      31 34 38 59       3 18 21 57
 2  7 39 53      31 38 59 89      50 64 66 83
16 27 58 83       7 31 85 89      34 38 43 79
16 23 27 58       7 31 53 89       7 66 79 85
23 27 35 58       7  9 53 63      33 39 53 90
19 23 27 65       7  9 60 89      35 36 38 89
16 23 57 58       7  9 60 63      16 33 57 58
16 17 57 58       7  9 63 90      17 46 57 65
23 57 58 82       7  9 47 53       1 17 46 65
23 35 57 58      50 66 83 85      35 44 51 89
35 44 57 58      50 83 85 89      44 46 52 53
14 16 17 61      29 50 85 89      44 46 53 57
 8 14 16 17      29 50 72 89      38 51 56 89
 8 14 17 19      29 50 72 74       8 33 39 53
11 14 17 19      34 50 72 92       6 10 24 74
 6  8 16 17       1  5 11 15       3  4 10 74
 2 60 67 70       1  5 11 12      38 51 56 89
```

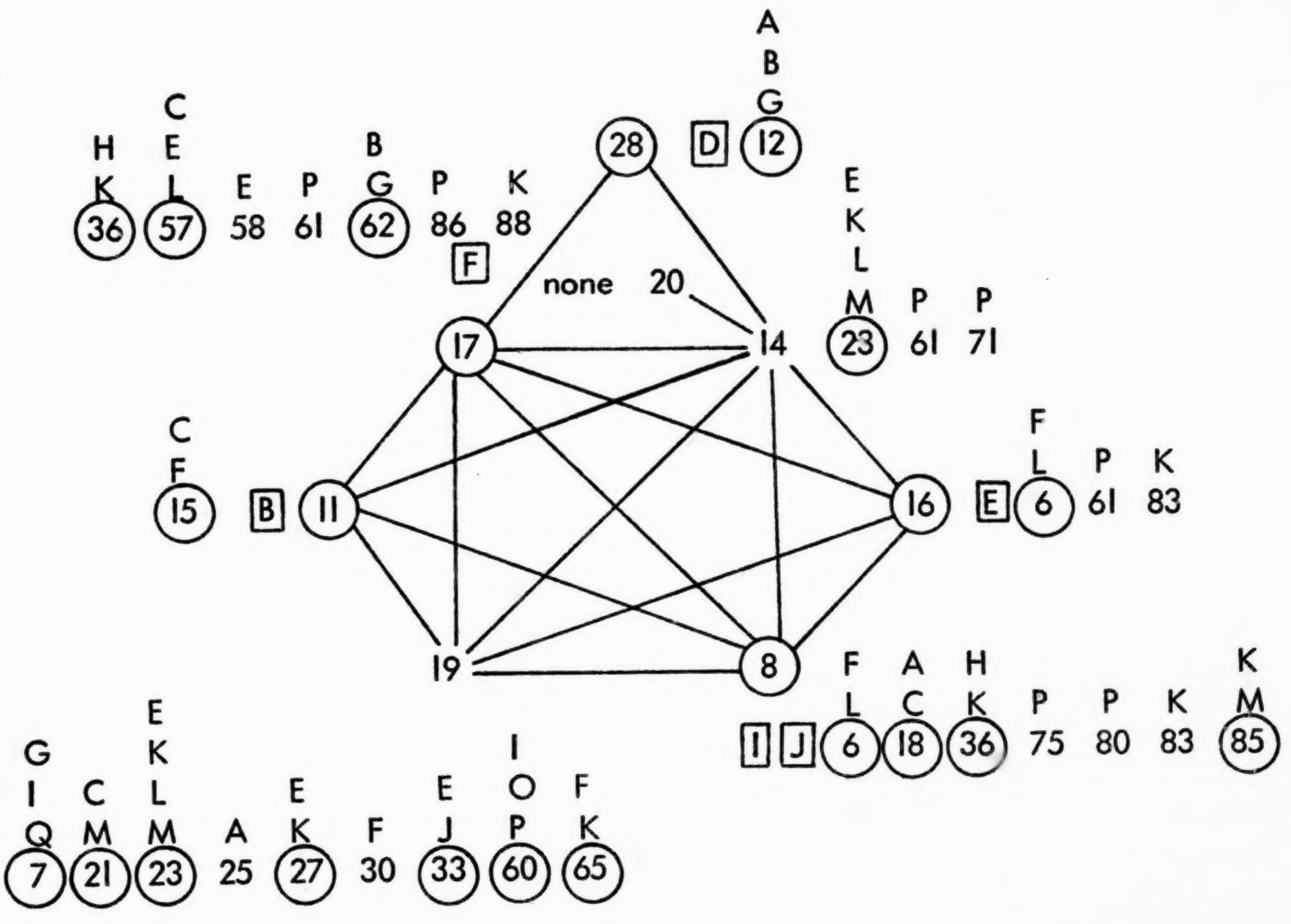
STRUCTURING

The procedure used in structuring the results of the decomposition programs is divided into four steps. The five stages of the structure represented on the following pages do not necessarily correspond to completion of any of these steps, but are, instead, a record of the structure at the end of each day's work session. Each session was approximately four hours in length and involved from four to ten students and the instructor. The steps are overlapping and the progression into the succeeding step is dependent on the structure's relative state of completion.

Step 1. Condensation of the various HIDEC results: The HIDEC program gives adequate results for establishing a rough approximation of the hierarchy. Because the program keeps partitioning requirements until no sets are larger than eight, the last partition is very often 8/1 or 8/2. This type of split should be restored to its former level. Since the program tries to maintain a balance in the number of requirements on each side of the split, requirements with few interactions in the total set are very often shifted to the smaller side of the split since they have very little effect on the number of links cut in the split. Consequently, certain sets shown may be only the result of a succession of shifts to the smaller side and could, conceivably, contain no internal linkages. Therefore, all sets should be checked for their relative density of linkages and requirements that are in weak sets should be incorporated into those sets where they have the most links. The separate HIDEC program results should then be superimposed in order to produce one "tree" structure of subsets.

Step 2. Initial structuring of subsets: Using the results of HYPAP and SIMPX as a guide in the identification of major "clusters" of the structure, a comparison should be made with the sets in the new HIDEC structure. At this point, requirements are both shifted from subsets where they are weakly linked and/or repeated in other subsets if they are highly linked to more than one. As a "rule of thumb", requirements either remain or are placed in a subset if a minimum of four "new" links are made intact, (i.e., links not duplicated in another subset) or one half the links of an individual requirement are present within the subset.

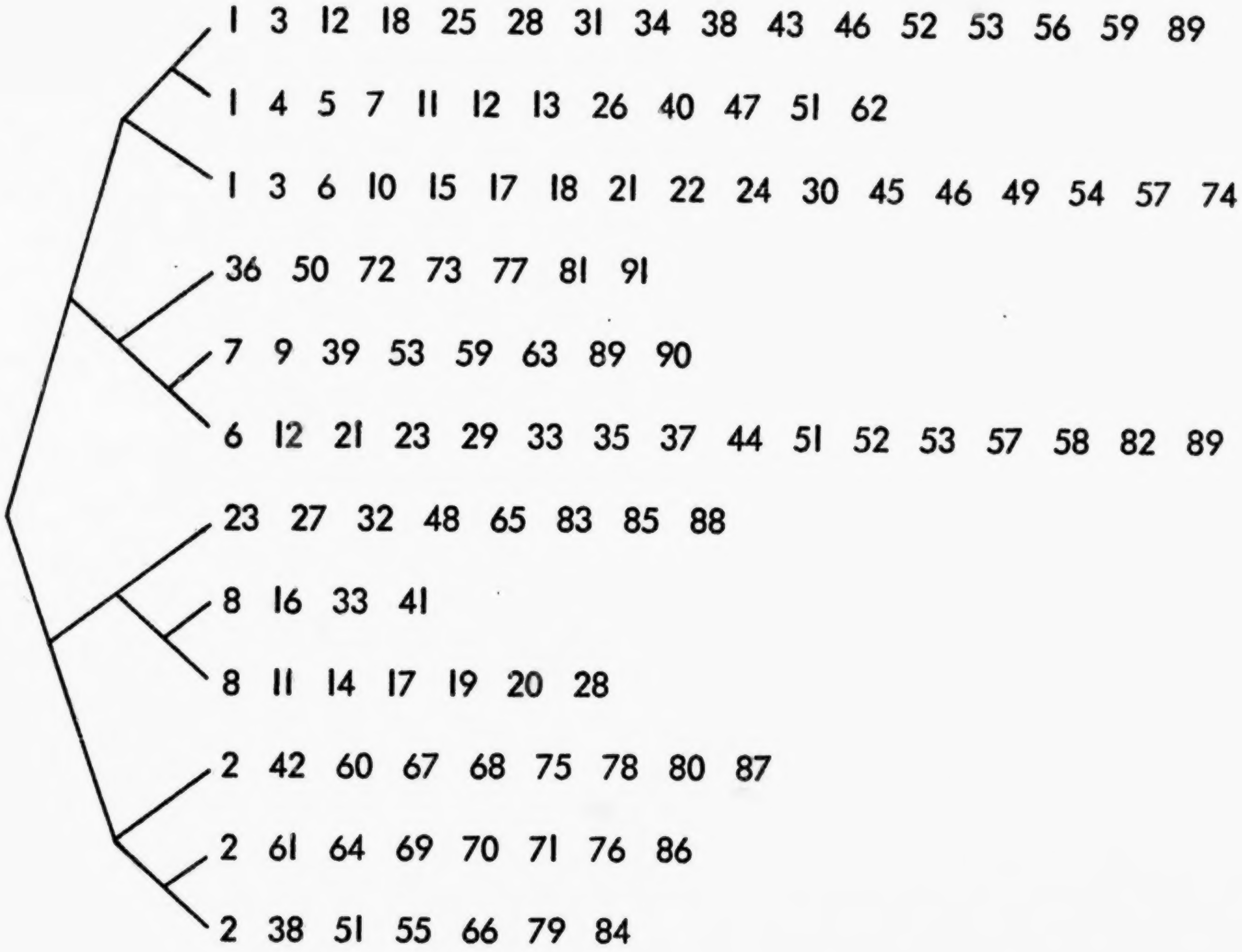
Step 3. Final structuring of subsets: After the results of HYPAP and SIMPX have been exhausted, a more refined structuring process should be introduced. This is accomplished by constructing graphically the lattice network for each of the existing subsets. An example of the final subset, "N", at this stage is shown on the next page. A circle around a requirement indicates that it appears in more than one subset and the letters next to it identify those other subsets. The requirements listed after each requirement in the subset indicate those links that are neither present in this subsystem *nor in any other subsystem*. The letters above each of these requirements indicate in which sets these requirements are located.



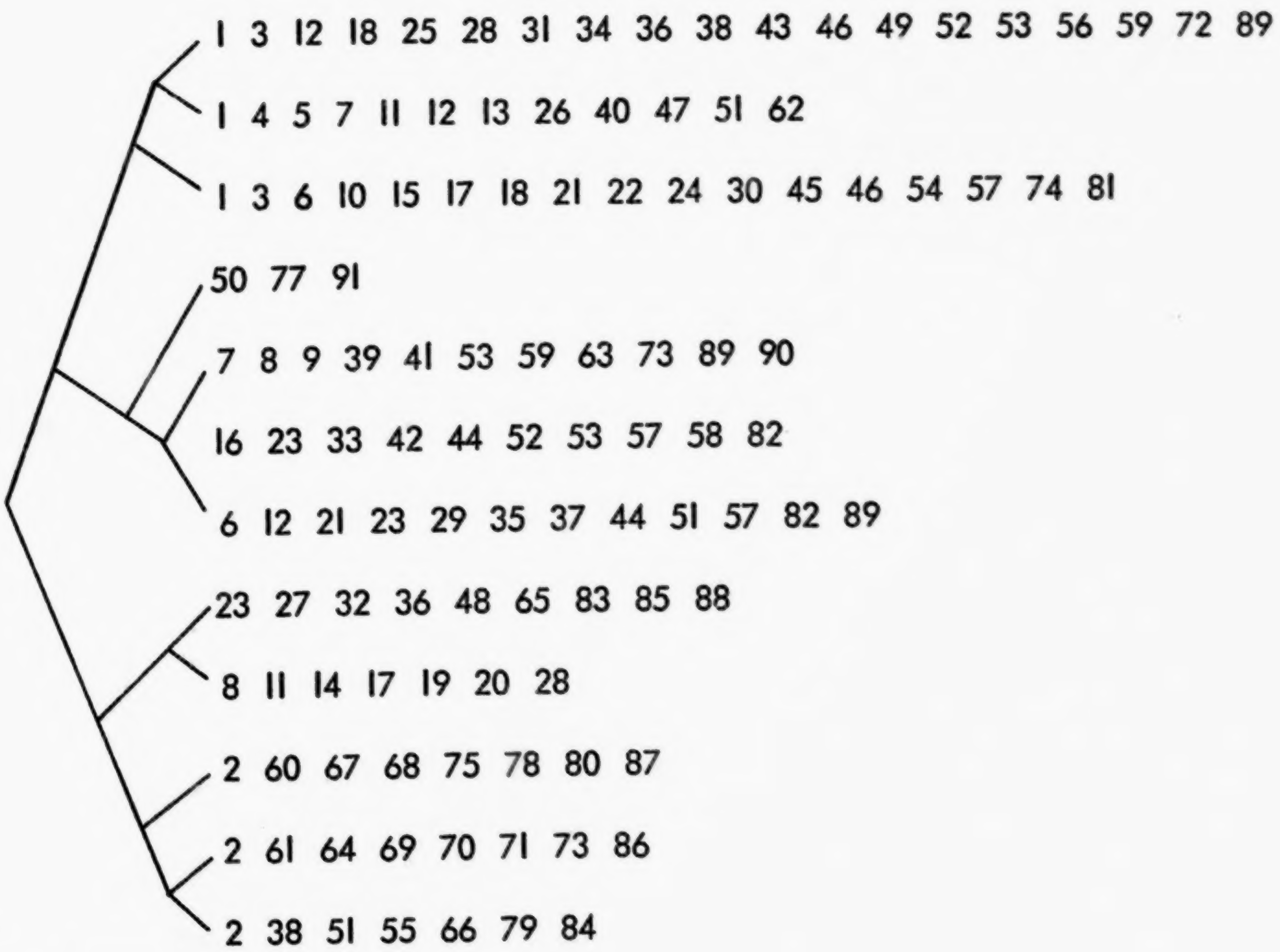
A B G
D
12
28
H K 36
C E L 57
E 58
P 61
B G 62
P 86
K 88
F
none
20
17
14
E K L M 23
P 61
P 71
C F 15
B
11
16
E
F L 6
P 61
K 83
19
8
I
J
F L 6
A C 18
H K 36
P 75
P 80
K 83
K M 85
G I Q 7
C M 21
E K L M 23
A 25
E K 27
F 30
E J 33
I O P 60
F K 65

Using this lattice, it is very easy to locate those requirements which would tend to strengthen the particular subset by scanning all those numbers adjacent to each of the requirements and employing the "rule of thumb" mentioned in Step 2. By scanning those letters appearing after any particular requirement and employing the same "rule of thumb," it is very easy to locate subsystems where that particular requirement might be repeated or shifted. At this stage, any splitting of the larger subsets into two overlapping subsets can also be accomplished.

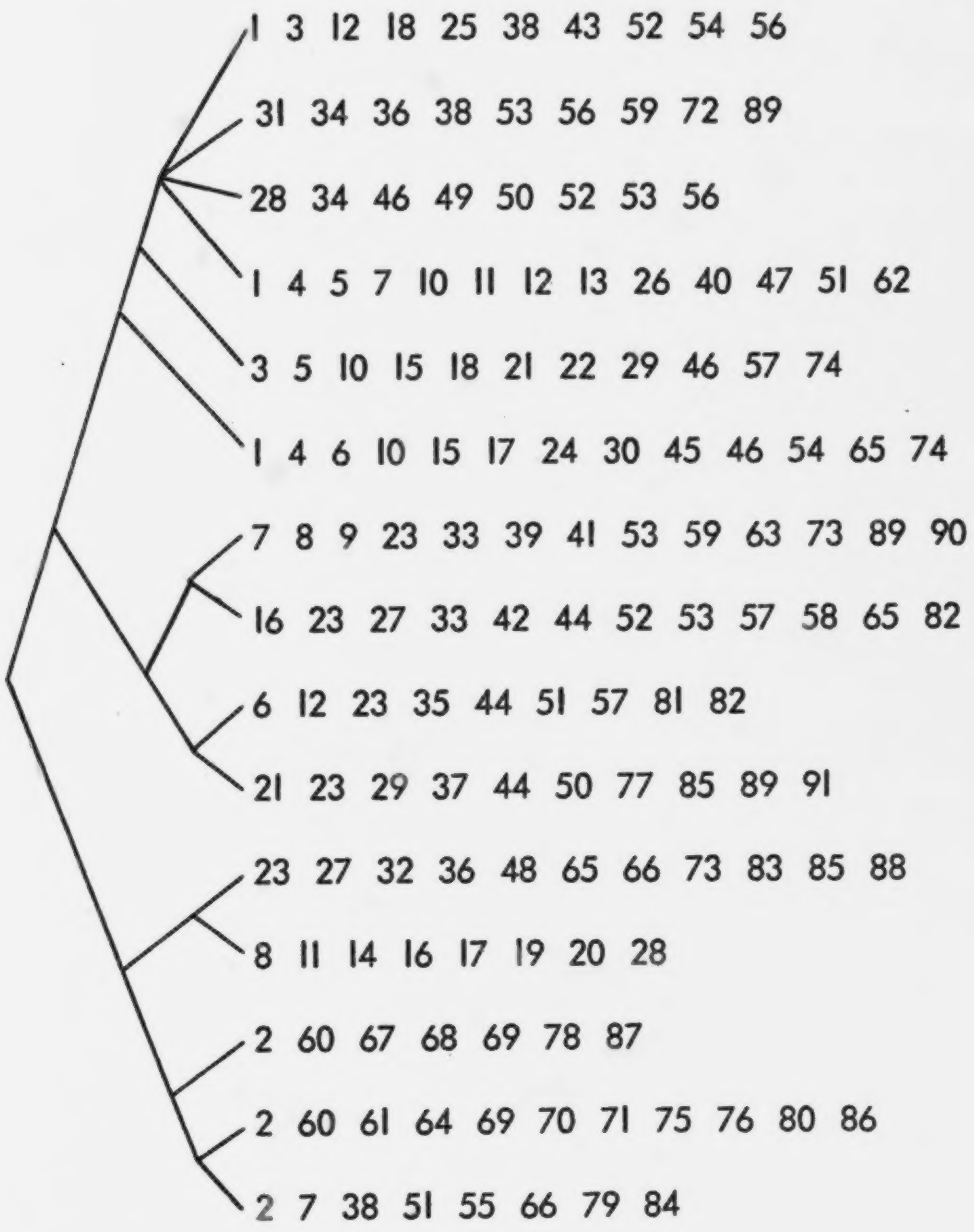
Step 4. Final structuring of the hierarchy: Although care should be taken to preserve the "tree" structure indicated by the HIDEC programs during the preceding steps, the extent of the restructuring during these steps will usually necessitate an investigation and restructuring of the hierarchy. The criterion for structuring of the hierarchy is one of restoring the largest number of cut links at the lowest level of the hierarchy. Using the lattice constructed in Step 3, those subsets which are closely linked can be determined. This information, combined with the modified "tree" structure carried through the preceding steps, is sufficient to establish a "semi-lattice" structure approximating the most natural combinations of the subsets into larger sets.


1 3 12 18 25 28 31 34 38 43 46 52 53 56 59 89
1 4 5 7 11 12 13 26 40 47 51 62
1 3 6 10 15 17 18 21 22 24 30 45 46 49 54 57 74
36 50 72 73 77 81 91
7 9 39 53 59 63 89 90
6 12 21 23 29 33 35 37 44 51 52 53 57 58 82 89
23 27 32 48 65 83 85 88
8 16 33 41
8 11 14 17 19 20 28
2 42 60 67 68 75 78 80 87
2 61 64 69 70 71 76 86
2 38 51 55 66 79 84

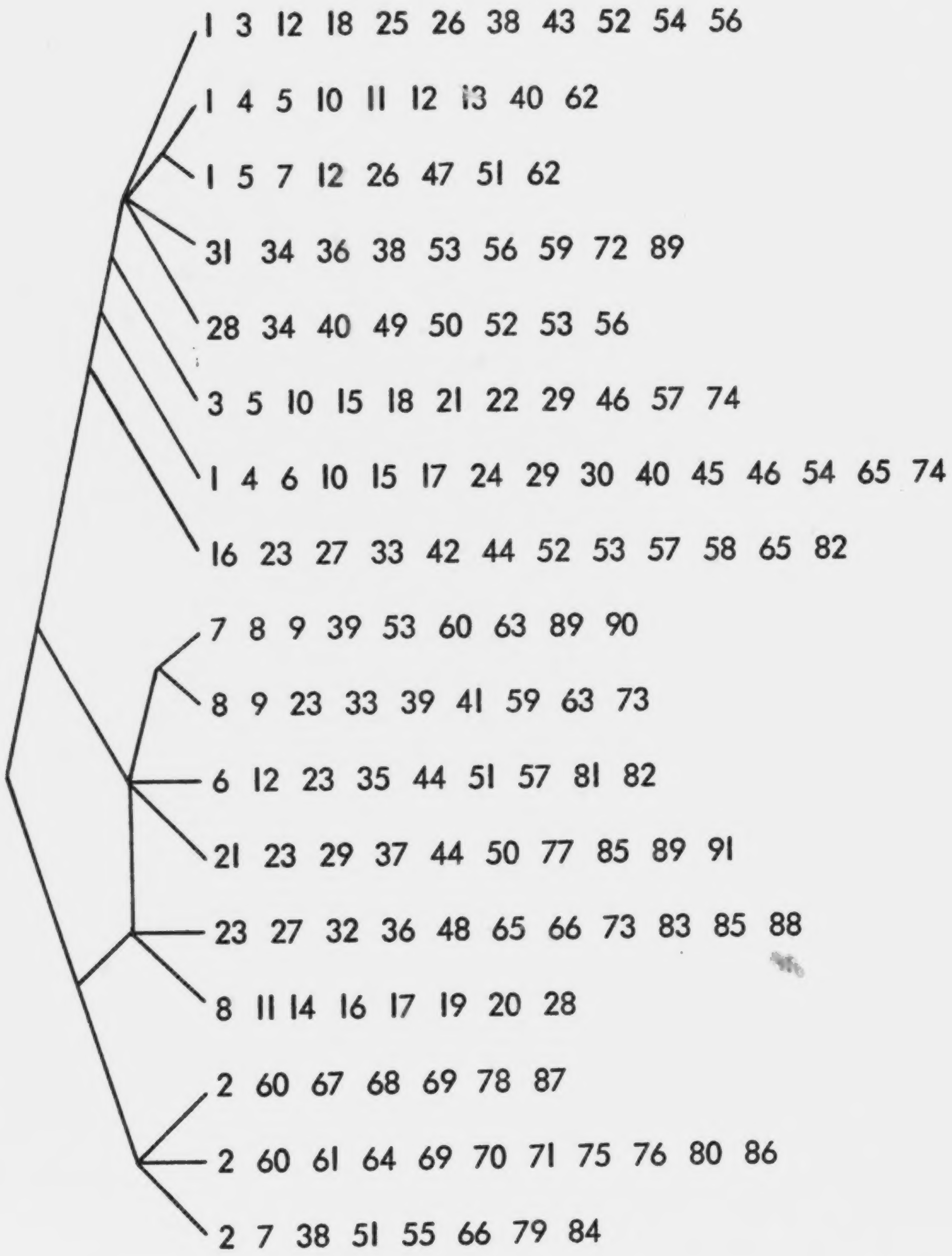
STAGE I
Condensation and refinement of HIDEC structure.


1 3 12 18 25 28 31 34 36 38 43 46 49 52 53 56 59 72 89
1 4 5 7 11 12 13 26 40 47 51 62
1 3 6 10 15 17 18 21 22 24 30 45 46 54 57 74 81
50 77 91
7 8 9 39 41 53 59 63 73 89 90
16 23 33 42 44 52 53 57 58 82
6 12 21 23 29 35 37 44 51 57 82 89
23 27 32 36 48 65 83 85 88
8 11 14 17 19 20 28
2 60 67 68 75 78 80 87
2 61 64 69 70 71 73 86
2 38 51 55 66 79 84

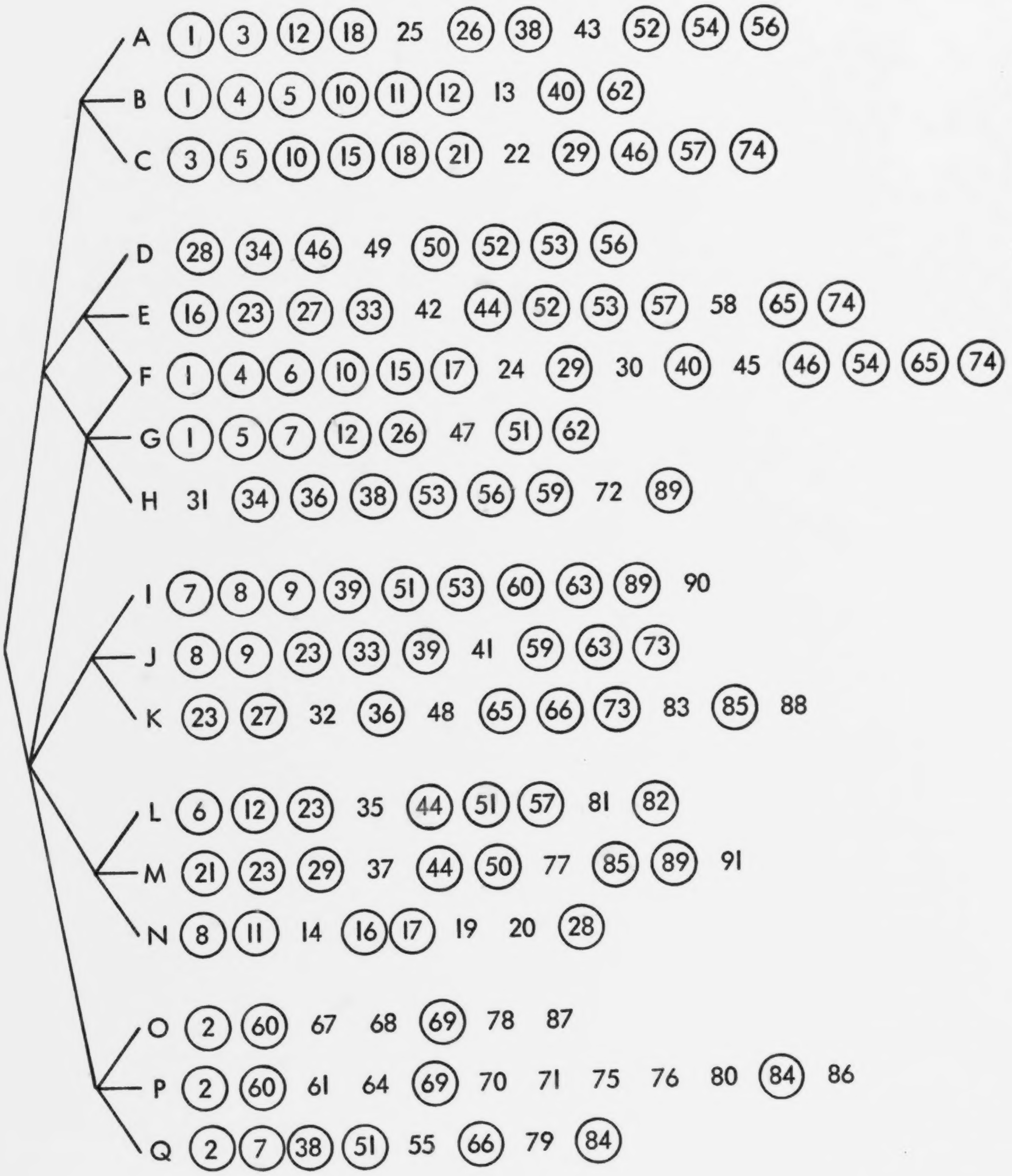
STAGE 2
Initial structuring of subsets in HIDEC structure using results of HYPAP and SIMPX


1 3 12 18 25 38 43 52 54 56
31 34 36 38 53 56 59 72 89
28 34 46 49 50 52 53 56
1 4 5 7 10 11 12 13 26 40 47 51 62
3 5 10 15 18 21 22 29 46 57 74
1 4 6 10 15 17 24 30 45 46 54 65 74
7 8 9 23 33 39 41 53 59 63 73 89 90
16 23 27 33 42 44 52 53 57 58 65 82
6 12 23 35 44 51 57 81 82
21 23 29 37 44 50 77 85 89 91
23 27 32 36 48 65 66 73 83 85 88
8 11 14 16 17 19 20 28
2 60 67 68 69 78 87
2 60 61 64 69 70 71 75 76 80 86
2 7 38 51 55 66 79 84

STAGE 3
Final structuring of subsets. Initial splitting of larger subsets.


1 3 12 18 25 26 38 43 52 54 56
1 4 5 10 11 12 13 40 62
1 5 7 12 26 47 51 62
31 34 36 38 53 56 59 72 89
28 34 40 49 50 52 53 56
3 5 10 15 18 21 22 29 46 57 74
1 4 6 10 15 17 24 29 30 40 45 46 54 65 74
16 23 27 33 42 44 52 53 57 58 65 82
7 8 9 39 53 60 63 89 90
8 9 23 33 39 41 59 63 73
6 12 23 35 44 51 57 81 82
21 23 29 37 44 50 77 85 89 91
23 27 32 36 48 65 66 73 83 85 88
8 11 14 16 17 19 20 28
2 60 67 68 69 78 87
2 60 61 64 69 70 71 75 76 80 86
2 7 38 51 55 66 79 84

STAGE 4
Final structuring of subsets. Further splitting of larger subsets.


A ①③⑫⑱ 25 ㉖㊳ 43 (52)(54)(56)
B ①④⑤⑩⑪⑫ 13 ㊵ (62)
C ③⑤⑩⑮⑱㉑ 22 ㉙㊻ (57)(74)
D ㉘㉞㊻ 49 ㊿ (52)(53)(56)
E ⑯㉓㉗㉝ 42 ㊹ (52)(53)(57) 58 (65)(74)
F ①④⑥⑩⑮⑰ 24 ㉙ 30 ㊵ 45 ㊻ (54)(65)(74)
G ①⑤⑦⑫㉖ 47 (51)(62)
H 31 ㉞㊱㊳ (53)(56)(59) 72 (89)
I ⑦⑧⑨㊴ (51)(53)(60)(63)(89) 90
J ⑧⑨㉓㉝㊴ 41 (59)(63)(73)
K ㉓㉗ 32 ㊱ 48 (65)(66)(73) 83 (85) 88
L ⑥⑫㉓ 35 ㊹ (51)(57) 81 (82)
M ㉑㉓㉙ 37 ㊹㊿ 77 (85)(89) 91
N ⑧⑪ 14 ⑯⑰ 19 20 ㉘
O ② (60) 67 68 (69) 78 87
P ② (60) 61 64 (69) 70 71 75 76 80 (84) 86
Q ②⑦㊳ (51) 55 (66) 79 (84)

STAGE 5 FINAL STRUCTURE
Final structuring of semi-lattice hierarchy.

66% of interactions intact in subsets
81% of interactions intact in 1st combination
98% of interactions intact in 2nd combination
100% of interactions intact in 3rd combination

APPENDIX C: FORM SOLUTIONS FOR SUBSYSTEMS AND COMBINATIONS

APPENDIX C

FORM SOLUTIONS FOR SUBSYSTEMS AND COMBINATIONS

The following material is presented in four sections. The first is a development of all of the form solutions for the individual subsystems. The second is the development of the combinations at the second level of hierarchy. The third section is the result of the combinations at the third level of hierarchy and the fourth section is the final combination.

Although the development of the subsystems and the subsequent combinations follow a somewhat similar format, they often reflect a variety of individual approaches in the detailed investigation preceeding the final form solution. However, in all cases the attempt was to make explicit those interpretations and decisions that went into the development.

In the process of combining, information form the lower levels of the hierarchy is often diagramatically simplified or merely implied in the presentation of the combination. Because of this, a full understanding of the higher level combinations requires an intimate knowledge of their components.

REQUIREMENTS:

1. When unable to determine his location by familiar reference points, a blind child will be insecure in his movements.

3. A blind child's dependence on physical contact for locating and identifying objects often results in injury when the objects are confronted unexpectedly.

12. When a blind child's practice in mobility and orientation is restricted to a known environment, he becomes confused and insecure in a new or changing environment.

18. Because a blind child initially perceives objects as obstacles, harsh contact with them inhibits his desire to become mobile.

25. Because a blind child fears injury to himself or others, he is hesitant in moving through unfamiliar surroundings.

26. Confusion and insecurity in an unfamiliar environment often inhibit a blind child from seeking aid.

38. If a blind child is not allowed to gain experience outside his customary environment, his dependence on that environment is increased.

43. If a blind child's environment is significantly altered, he adjusts to the change in a fragmentary--rather than gradual, comprehensive--manner.

52. If a mentally-handicapped blind child does not sense physical danger, he can easily injure himself through his uninhibited movement.

54. If a blind child must explore an object or situation at length in order to identify it, his reaction to it is often delayed.

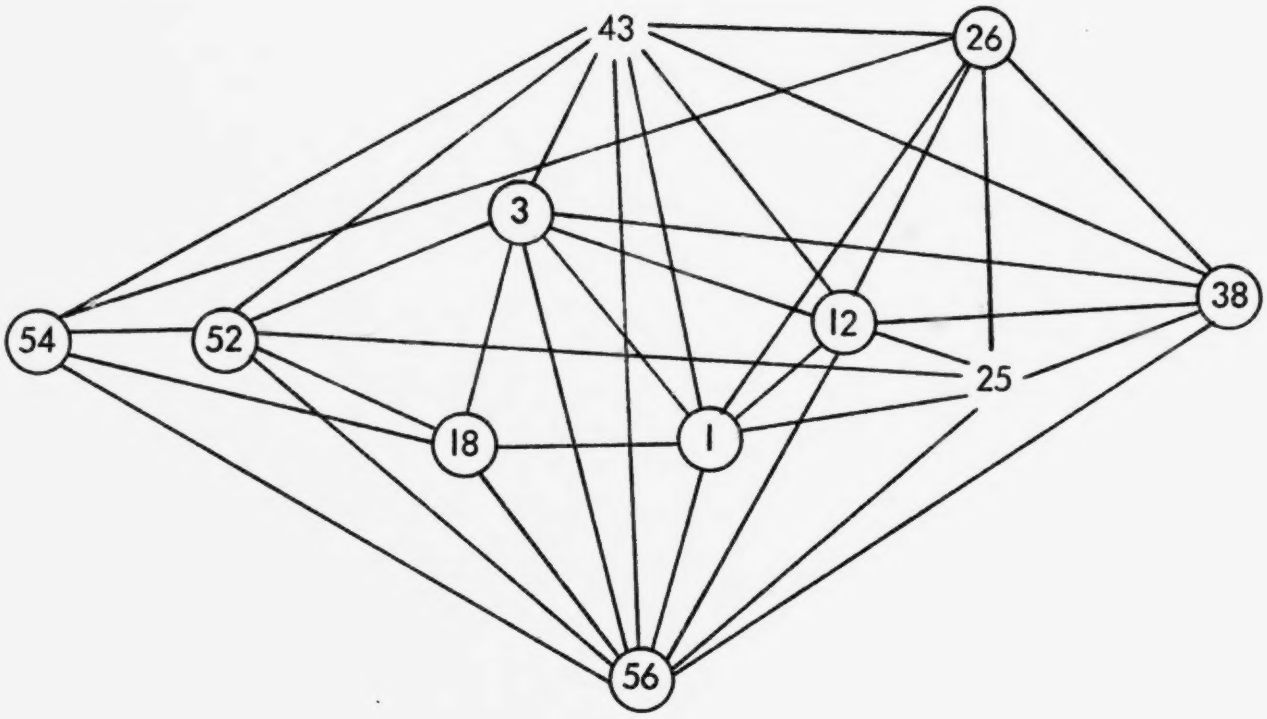
56. Since a blind child's fragmented perception--of parts rather than wholes--does not show him immediately which parts are potentially dangerous, he will hesitate to explore an unfamiliar environment.

A

Relational Topic

This subsystem is concerned with the blind child's physical safety and the development of his ability to use his environment as an aid. Through an environment consisting of a combination of changing areas contained within a stable overall structure, the blind child is prevented from becoming solely dependent upon the school environment; and at the same time he becomes familiar with adaptation to change and development of methods of orientation.

Lattice



Discussion

Key interaction and corresponding solution statements:

Mentally-Handicapped:

-(43,52): The mentally-handicapped child's environment should not be changed, but should remain fixed.
-(18,52): Provide simpler environment for the mentally-handicapped. He should be separated from normal blind.
-(52,54): The mentally-handicapped child's environment should be simple so as to eliminate injury.
-(25,52): A mentally-handicapped child should be given a definite sign in change of areas, so that he knows he is making a change.

Similarity to Sighted Environment:

-(18,56): Maintain the same relationships between objects or spaces in the school as those that occur in the sighted environment.
-(38,43): The school's environment should be similar enough to the sighted environment so that the change from one to the other will not be significant.
-(1,26) : The methods used by a blind child in seeking aid in his customary environment should employ devices he will encounter in the outside environment.

Aid:

-(26,54): Ways of seeking aid should be evident and simple.
-(25,26): All environments within the school must have similar ways of getting aid.
-(26,38): Give the child an unfamiliar new environment so that he will learn how to seek aid.

Change within the School:

-(26,43): When the environment changes, enough common reference points should always remain so that the child will be able to seek aid.
-(3,12) : Do not limit the child to one environment.
-(1,12) : The child's environment should not be static, but continuously changing - flexible.
-(12,43): Give the blind child enough exposure to a new or changing environment and he will learn to adjust more readily and easily.
-(1,43) : Retain familiar reference points in any kind of change within the environment so that the blind child will be able to orient himself.
-(25,43): Changes in the blind child's immediate environment should be gradual and comprehensive.
-(1,3) : Establish the same set of relationships between objects that repeat throughout the school to prevent a child from confronting these objects unexpectedly.
-(3,43) : Any changes in the blind child's environment should be logically ordered so that the set relationships he has come to expect are not changed.

Control of Change:

-(54,56): Don't put the child in a situation in which past experience is necessary if he doesn't have that past experience.

-(1,25) : Teach the child to use hearing and sense of smell to guide him.

Subset 1: (1, 3, 12, 26, 38, 56):
Don't limit the child to one environment (area), but all of the areas to which he is exposed should have the same set of stable relationships for him to relate to and the same way of seeking aid.

Subset 2: (18, 25, 43, 52, 54, 56):
Require the child to move through different experiences or situations within the school. This variance in experience can happen through gradual physical change within one environment or by exposing the child to different environments all within (or without) the school. For the mentally-handicapped this must occur under supervision.

Subset 3: (1, 3, 12, 43, 56):
The blind child should be given practice in moving and orienting himself in a new or changing environment, but this change should occur gradually so that he will be able to understand it. Instead of the environment changing, the child should change his location in the school and thus experience new environments. These new environments must have some resemblance or set of relations that he can already handle and understand.

Form Statements:

Mentally-Handicapped: Because the mentally-handicapped blind child's comprehension is low and his perceptual development is slow, he must be put into a simplified environment where he can understand the few and simple experiences offered by that environment. To accomplish this:

1. his living and learning environment should be one and the same.
2. there should be no objects that may cause serious injury.
3. the various facilities and functions of this environment should overlap as much as possible to decrease its size.
4. physical barriers should prohibit movement from this specialized environment to any other environment.
5. he should be given a definite clue when he crosses from one space to another.
6. he should be separated from "normal" blind children until he reaches a level where he can successfully operate in a more complex environment.

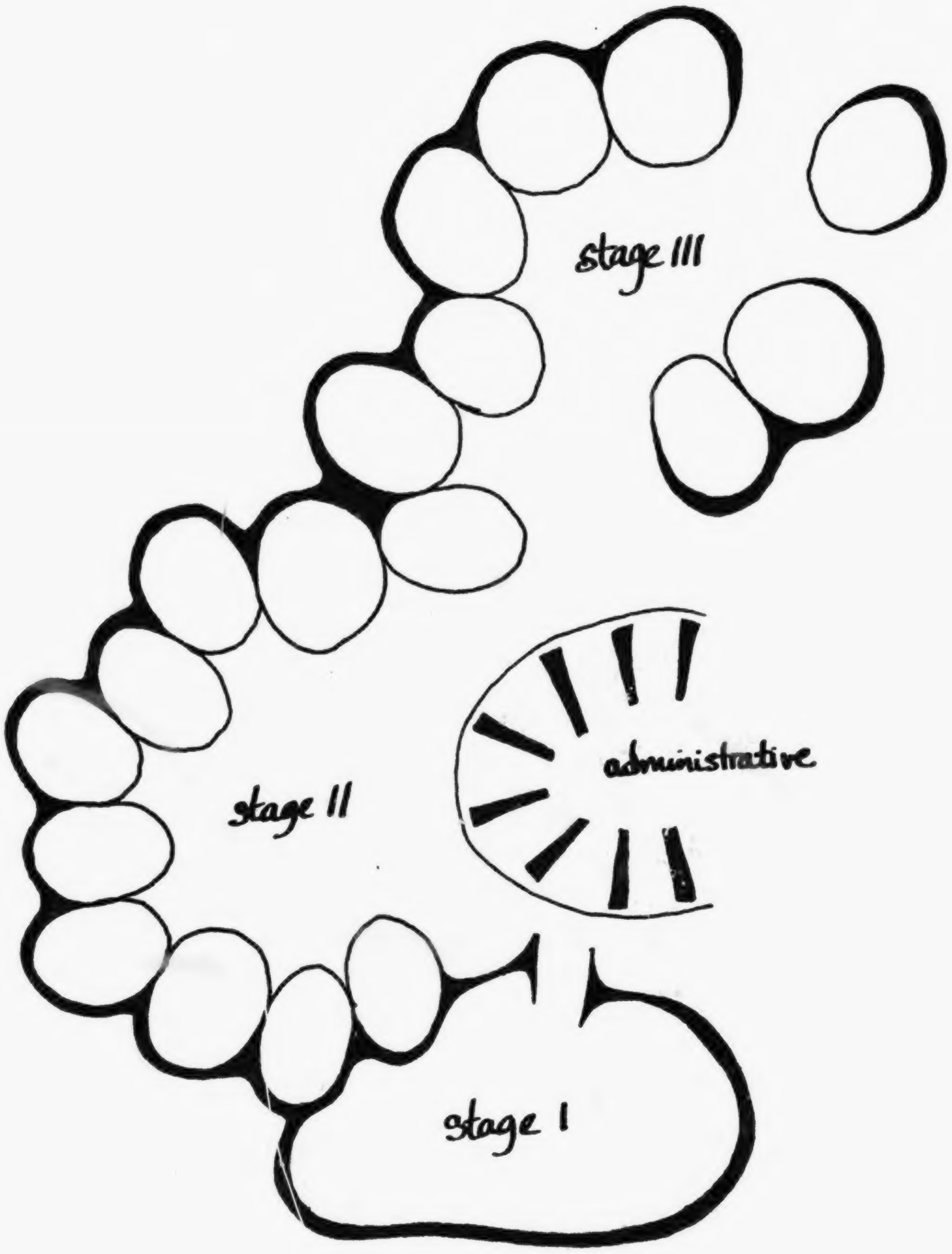
"Normal" Blind: The design which evolved from this subsystem is aimed at developing the perception and understanding of the blind child in a manner that will best prepare him for the sighted environment. It is concerned with developing the childs abilities of perception of spatial relations, seeking aides, and adapting to change. This goal is best accomplished by familiarizing the child with the same experiences he will encounter in the sighted environment. To accomplish this:

7. Living and learning environments should be separated as much as possible, with the activities of the learning environment also diffused and separated.

8. There should be no specialized environment.
9. The noise level of the outside environment should be loud enough and definite enough in comparison with the level of the child's environment that it clearly defines his boundary.
10. The living and learning environments should be separated from each other so that the blind child must pass through this new, outside environment to get from one to the other.
11. His environment should offer choices in paths between different areas.
12. The control of injury can be achieved by supervision and if objects which may cause possible harm are safe-guarded.
13. No physical or authoritarian barriers should exist between the advanced child's customary environments and the sighted environments.

Description of Diagram:

The administrators' and instructors' offices are situated centrally with complete and direct visual and physical access to the rest of the school. This controls injury in the open area which is used as a common circulation area where there is great choice in circulation paths. (12)(11) Stage I is for the mentally-handicapped and is simplified and set apart from the rest of the school through the use of a physical movement barrier. (4)(6) The various learning activity areas in Stage II are placed around the common area circulation space with access points placed so as to require the child to go through the circulation space. In Stage III there is no specific form taken by the class activity areas. It does have direct and uncontrolled access to the sighted environment. (13)


stage III
stage II
administrative
stage I

A

REQUIREMENTS:

1. When unable to determine his location by familiar reference points, a blind child will be insecure in his movements.

4. Because a blind child mentally notes a specific location for an object he frequently uses or encounters, he becomes confused if he finds the object has been moved or a different object is in that location.

5. Because a blind child explores his environment actively, through touch, he often feels insecure in his movements when that environment is unfamiliar.

10. Objects with similar forms and physical properties but different in purpose or intent are confusing to a blind child.

11. If a blind child receives no sound cues from his surroundings he will rely on self-generated noises to establish his position in space.

12. When a blind child's practice in mobility and orientation is restricted to a known environment, he becomes confused and insecure in a new or changing environment.

13. By mistaking a moveable object for a stable one, a blind child can misorient himself if he determines his location relative to that object.

40. When a blind child must concentrate on his immediate environment and destination, simultaneous participation in another activity is difficult.

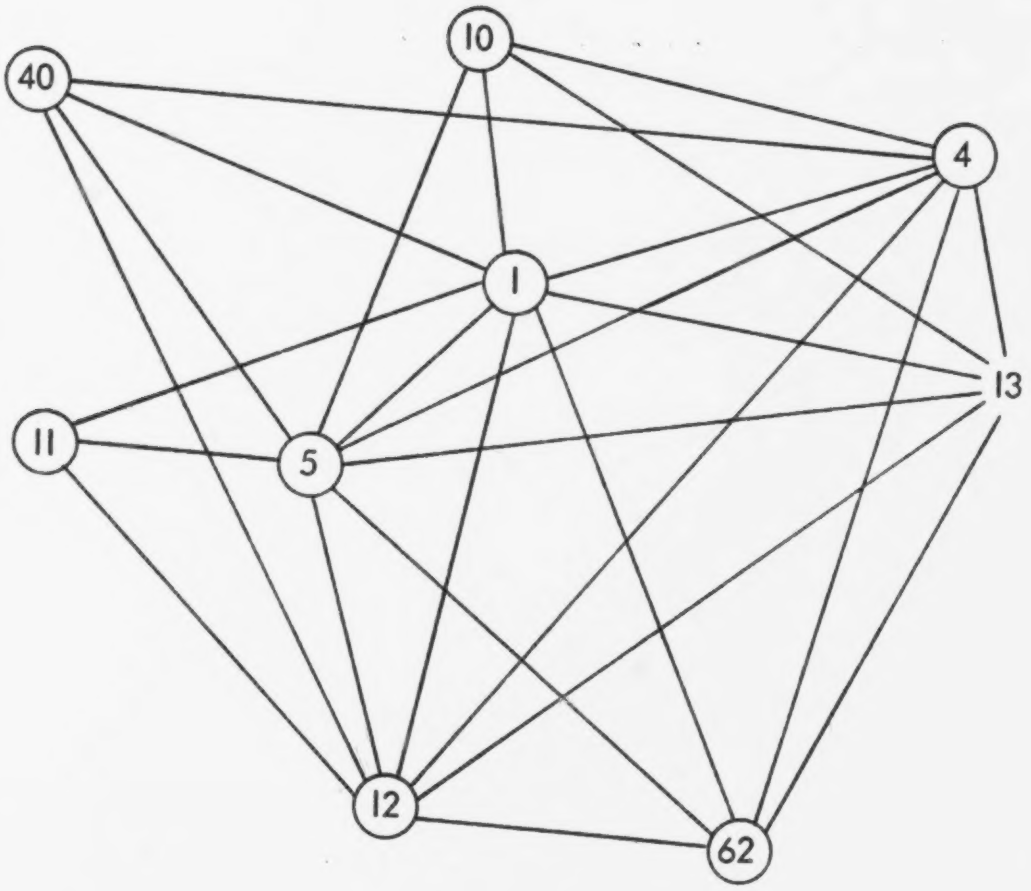
62. If a blind child loses his way, he often does not know where or how he erred.

B

Relational Topic

This subsystem deals with the blind child's mobility and orientation and the use of objects as cues.

Lattice



40
10
4
1
13
11
5
12
62

Discussion

The key interactions and their solutions statements are as follows:

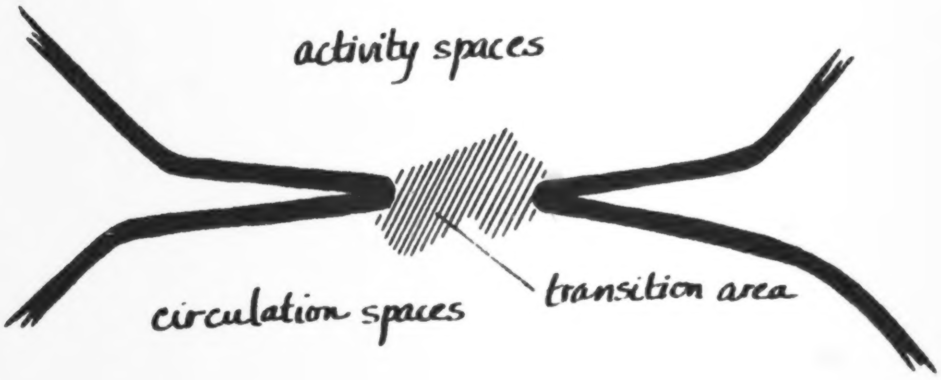
-(1,4,40) : Have a permanent system of reference points that is common to the outside world. Place them at a level where the blind child readily perceives.
-(1,4,40) : Make the reference points easily and quickly identifiable so that fatigue and time isn't necessary to orientation. Let the child find his way be determining his own location.
-(4,12) : Let him experience unknown environments so that he can learn for himself the reliability and organization of stable and unstable objects.
-(4,12,40) : When the child is in an unknown environment let him have the same stable reference points that he is used to but don't make him participate in another activity besides that of knowing where he is and where he is going.
-(4,40,62) : Make the reference point tactile and permanent as well as being easily and quickly identifiable.
-(5,10,40) : Areas that require simultaneous participation in two activities should be structured so that one is extremely simple and easy to follow by way of single purpose tactile reference points that are provided.
-(1,5,11) : Let there be sound. Give him sound cues as reference points, and have the sounds common to the outside so he will be able to use them when there.
-4 vs 12 : Conflict -- 4: keep environment familiar and therefore unchanging
12: give child the chance to use an unfamiliar environment.

Form Solution:

Provide a number of sound sources -- hopefully not continuous, so the blind child can determine his location by triangulation.

Activity spaces and circulation spaces do not overlap.

Transitional areas should be perceptually marked so that the blind child can be aware of crossing them.


activity spaces
circulation spaces
transition area

B

REQUIREMENTS:

3. A blind child's dependence on physical contact for locating and identifying objects often results in injury when the objects are confronted unexpectedly.

5. Because a blind child explores his environment actively, through touch, he often feels insecure in his movements when that environment is unfamiliar.

10. Objects with similar forms and physical properties but different in purpose or intent are confusing to a blind child.

15. Objects without a unique characteristic are difficult for a blind child to remember.

18. Because a blind child initially perceives objects as obstacles, harsh contact with them inhibits his desire to become mobile.

21. A blind child's lack of curiosity to explore his environment will impede his progress in achieving coordination and control over his bodily movements.

22. Marked transition periods between class activities require additional time to regain the student's attention.

29. When a change in activities necessitates a change in location, the time spent moving is often non-productive.

46. Because hyperactive children are often unable to discern pertinent stimuli, either they fail to react to important stimuli or they react to all stimuli equally.

57. Because a hyperactive child releases his energy vigorously, limiting his actions will frustrate him.

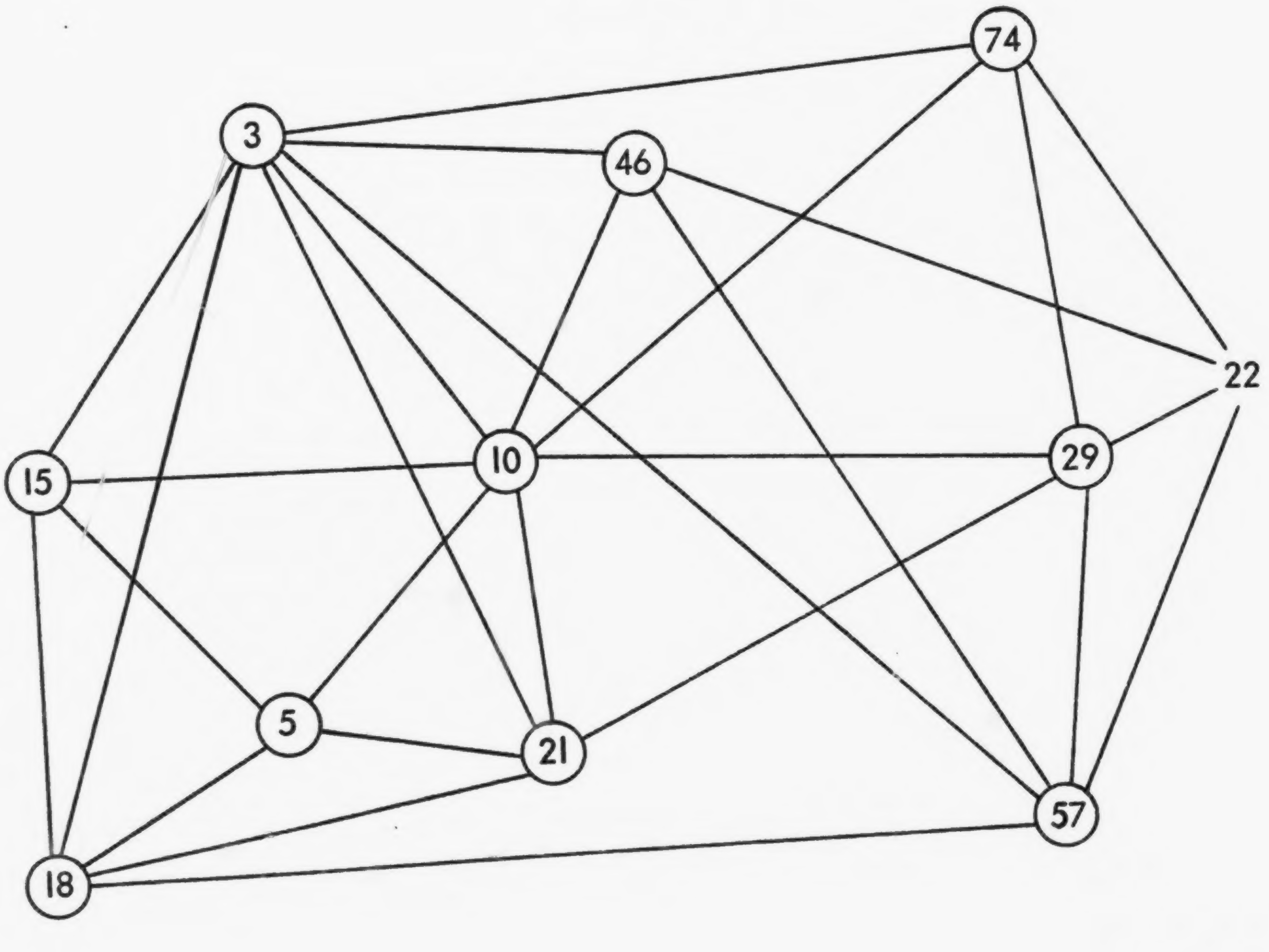
74. If materials or movement necessary to effect an activity cannot be applied without disruption or delay, teacher-therapists often disallow the activity.

C

Relational Topic

The blind child's environment is a structured learning experience in itself. Repeated contact with this environment familiarizes the blind child with key experiences he will come in contact with in the sighted environment. It familiarizes him with these experiences by making them necessary parts of his everyday routine. The school's organizational and physical structure encourages and develops his proficiency in mobility and perceptual skills.

Lattice



Discussion

Form solution statements derived from subset (3, 5, 10, 15):

1. The environment should be structured and organized to correspond to the sighted environment. The progression of spaces and their respective functions should have the same sequence as the sighted environment. The circulation system should stimulate the circulation system of the sighted environment.
2. The environment should be structured with the use of elements from the sighted environment and these should be used often by the students. They should occur wherever change occurs in spatial function, direction within circulation systems, volume of movement of circulation systems etc.
3. The school should be located in a transition area between urban and suburban areas with easy access to both. This transition area should be closer to the urban area and as narrow as possible. This will familiarize the child with sounds he will encounter in traveling through the sighted environment and will supply ready opportunity for his exploration of other environments.

Form solution statements derived from subset (3, 5, 15, 18):

4. The environment should be organized so that the blind child is supplied with a set of stimuli which informs him about the organization and placement of form elements (spaces, areas, furniture, etc.).
5. By examining his immediate environment the blind child must be able to determine exactly where he is without getting seriously injured. Therefore, the stimuli he first encounters in a space must not be injurous. Since he must receive a clue before bumping into something there can be no outcropping objects at levels where the child does not initially perceive.

Form solution statements derived from subset (3, 5, 10, 21):

6. Changing a child's total dependence on touch to a combination of touch and acoustics may help prevent many problems connected with touch alone. He must be made aware of acoustical changes and learn what they signify. Acoustical stimuli should occur within or penetrate into the school wher - ever and whenever possible. Tactual stimulation should not be de-emphasized. Acoustical stimuli should vary and must come from original sources.
7. The environment should be exciting and stimulating through a wide range of different and varying stimuli but should not be distracting in class.

Form solution statements derived from subset (3, 10, 21, 22, 29, 74):

8. Class room materials should have unchanging organization and location or clearly perceptable and quickly comprehended change. This means a minimum number of objects that are moved.

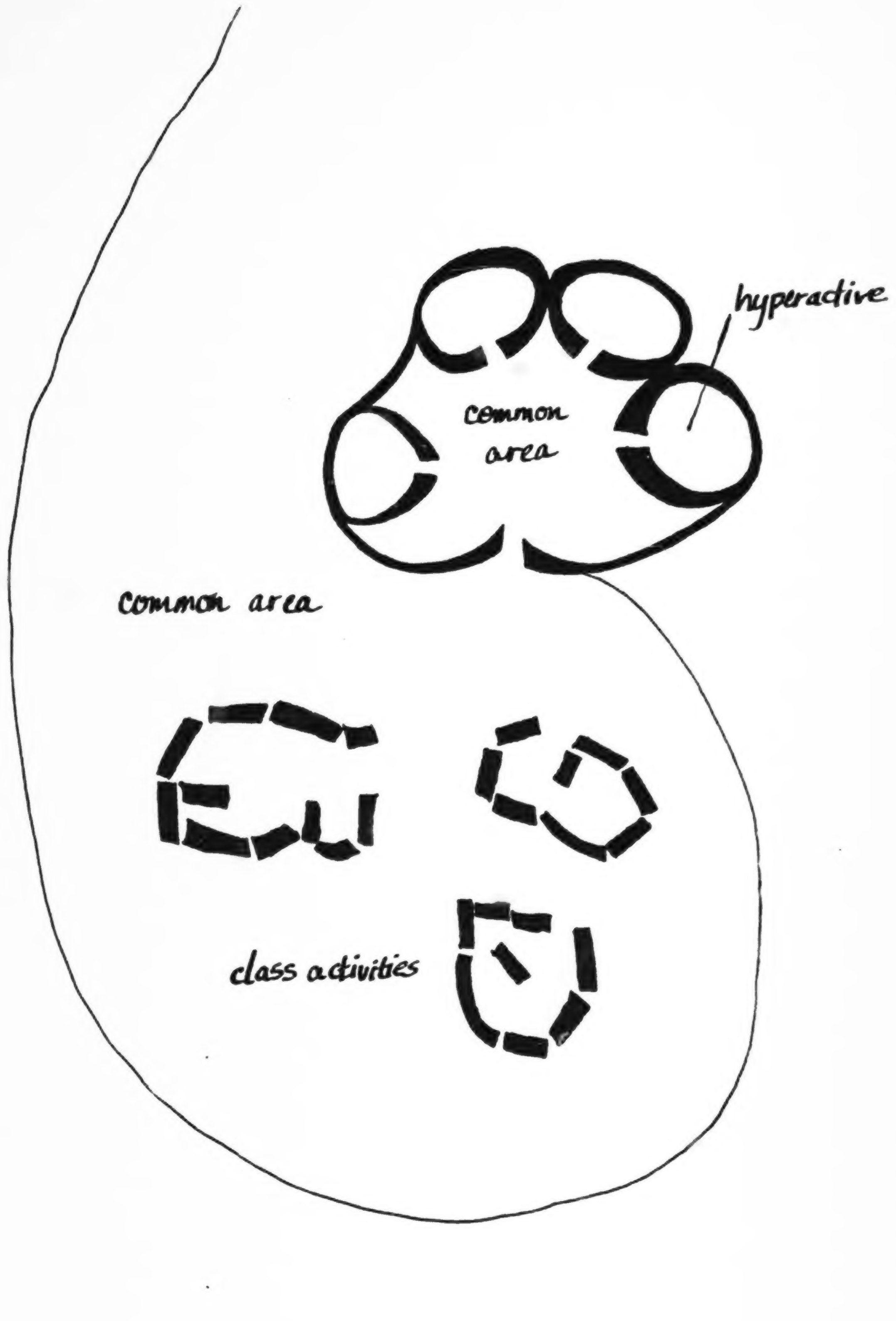
9. There should be control on the complexity of the class environment according to age and mental condition of students. Allow mental relaxation without introducing distractions to the class. Noise from outside of class should be present but not to the extent that it absorbs his thoughts, i.e. hearing people talk but not knowing what is being said. The partially sighted should be prevented from seeing activities outside class which are distracting, although changes in visual distance should be provided.
10. Physical movement between class activities should occur and should involve contact with elements possessing a variety of forms and function. There should not be disturbances (lingering distractions) which will prevent the regaining of students' attention in the next class activity. The class environment should present less distraction than the between class environment. The elements encountered should function as part of the environment rather than things to just observe. Some of the elements encountered should be changes in circulation systems. In going from one class activity area to another, the child must go through a circulation system. Either physical barriers should define the instruction areas and the circulation system, or the circulation system should surround and define the limits of the instruction areas.
11. The environmental structure encountered by the student in his movement between class activities should be easily and quickly navigable with potential for periodic changes which are easily and quickly perceptable and understood.
12. Class room materials necessary to effect an activity must be easily accessible and quickly set up. Wherever possible class materials should be the defining elements of the class space. They form the space in which they function. If they do not afford enough definition of the space, then physical objects whose function is space definition are used. These physical objects are used as movement barriers, sound baffles and visual baffles. These materials and physical objects must not be permanently in place but must be easily and simply moved, though not inadvertently. In order to avoid a system that requires a great deal of movement, each class space should have only one main activity function.

Form solution statements derived from subset (3, 10, 18, 21, 22, 46, 57):

13. For hyperactive children in a class activity, each stimuli must be easily and clearly perceived and differentiated. There should be a marked contrast between each stimuli and the stimuli must be relatively simple. (minimum distraction). There should be sound barriers to minimize external noise as much as possible and sound baffles to minimize self made noise irrelevant to the activity. There should be a reduction in space -- as small as possible without discomfort. The stimulus value of the teaching materials should be increased by minimizing other stimuli.
14. There should be a class separation between hyperactive and other blind children with the hyperactive classes containing as few children as possible. This separation should only occur in classes where long attention spans are required. The hyperactive child should come in contact with blind children in some supervised activities.

15. A hyperactive child's environment should not allow opportunities for serious injury by his vigorous release of energy.

Form Solution: In the accompanying diagram, the black rectangles forming class areas represent a combination of disturbance barrier, noise control and visual control (9); and class materials (12). These rectangles are elements of the class activity and as a change in class activity occurs, the elements defining the space correspondingly are rearranged (12). Openings between the black rectangles permit a small variation in the circulation pattern to occur when the activity changes (2, 4, 11). The number of openings and the complexity of their arrangement depends on the children's perceptual development (8), and can be controlled through the use of the space defining elements (10, 12). The more confined class areas above these areas are for the hyperactive blind (14). Here the environment is highly simplified (13) with only a single access point to each class area and to the common area (14).


hyperactive
common area
common area
class activities

C

REQUIREMENTS:

28. Because a blind child cannot visually identify a sound with its source, unfamiliar noises which are loud or harsh tend to frighten him.

34. If a blind child is made to feel dependent on either mobility aids or on patronizing people, he may develop a defeatist attitude about his becoming self-reliant.

46. Because hyperactive children are often unable to discern pertinent stimuli, either they fail to react to important stimuli or they react to all stimuli equally.

49. If a partially-sighted child's vision is limited by external forces, neither he nor others can rely on his visual recognition and/or interpretation for guidance.

50. If the handicapped child is not encouraged to develop his limited faculties, their usefulness will deteriorate.

52. If a mentally-handicapped blind child does not sense physical danger, he can easily injure himself through his uninhibited movement.

53. Excessive supervision of an activity provokes a blind child into reacting against the supervision rather than responding to the activity.

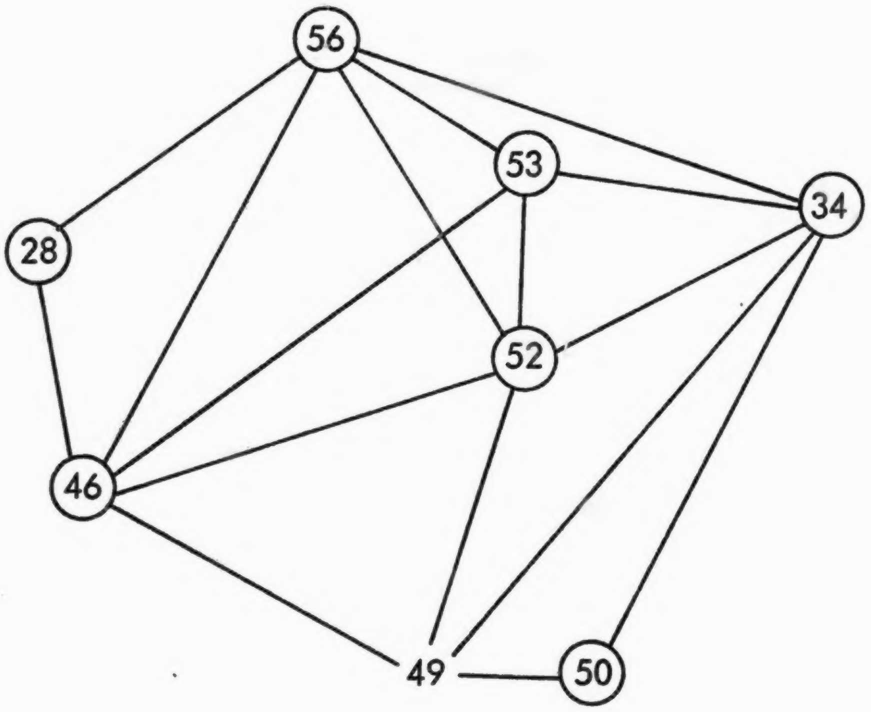
56. Since a blind child's fragmented perception--of parts rather than wholes--does not show him immediately which parts are potentially dangerous, he will hesitate to explore an unfamiliar environment.

Relational Topic

D

The dangers of injury to the mentally-handicapped through his uninhibited movement, decreased supervision with increased environment control, and circulation spaces related to certain aspects of any activity area.

Lattice



Discussion

This subsystem had eight requirements and fourteen interactions. In order to comprehend the nature of these interactions the original subsystem lattice was broken down into three subsets. The first subset included requirements (28,46,52,53,56). The form implications developed from this subset were, as follows:

1. A limited amount of environmental stimulations designed to be easily grasped by the hyperactive child.
2. Very structured activites and stimuli to make close supervision unnecessary .
3. Environment constructed to enable change from extreme simplicity, easily grasped by the untrained, hyperactive child, to any type of more complicated state.
4. Structured activities occuring within relatively small spaces.
5. Short distances between classrooms.
6. Transitions with only a few clear, intelligible stimuli, and controlled sounds.
7. Spaces with apparent textural and acoustical qualities.

The second subset is the simplex of requirements (34, 52, 53, 56). The form implications developed from this simplex were, as follows:

1. If the signals and cues which the child must identify can also be considered mobility aids then they should be a slight challenge.
2. Supervision should be provided where the child may encounter difficulty or danger.
3. If the hyperactive child withdraws from familiar, supervised activities injury to himself may result.

The third subset includes requirements (34, 46, 50, 52, 53, 49). The form implications developed from this subset are, as follows:

1. Light cues should be incorporated as stimuli whenever sighted or non-sighted children assist blind children.
2. Without endangering the hyperactive child, supervision should be decreased--the environment should be structured to take care of the child.

From the subsets appropriate solution statements were determined. These solution statements were not intended to supercede the original requirements of the subsystem, rather, they crystallized the content of the subsystem and were used as direct steps to a solution demanded by the requirements. After the solution statements were written, they appeared to be divided into two groups, transition areas and activity areas. The first group, transition areas, was, as follows:

- Minimize supervision (53, 34).
- Provide a consistent cue structure and transition system (56,34).
- Transitions are informal exercise areas (34,50).
- The transition spaces will be used according to the child's ability and level of education, i.e. the more he progresses the more complex his transitions become, and the more he is able to perceive and use them (34, 56, 52).

- Light should be used as a cue in transition spaces for the partially sighted (34, 49, 50).
- Transition spaces should be acoustically protected from activity spaces and visa versa (28).
- To avoid congestion, younger, non-mobility skilled children should not share the same transition spaces with more advanced children.

The second group of solution statements, dealing with activity areas, was broken down into three sub-areas representing three levels of progress and ability. The first sub-area was referred to as the beginning or intensive care.

- There shall be a 5 or 6 to one student/teacher-therapist ratio in multi-activity rooms.
- Children will only negotiate transition areas under supervision.
- Direct access to any area should be controlled.
- Individual areas shall be provided the hyperactive as needed or warranted by their state of mind.
- All daily activities of the children shall be accommodated for in a multi-activity room.
- Within a multi-activity room, sound barriers must be provided if one activity should be sound isolated from another concurrent activity.
- Activities should be allowed to occur anywhere in a multi-activity room with the teacher-therapists providing all the necessities for that activity.

The second sub-area was referred to as the intermediate level.

- At this level, children should be able to respond to instructions.
- Each child has a station assigned to him where all materials are within reach, avoiding his having to move about to find them.
- All locations, including the child's station, shall be quickly identifiable.
- The location of any group activity shall be equidistant from every station.
- A location should be provided for the group's equipment.
- All educational stimuli shall be received by the child at his individual station.
- Transition spaces should not have cross traffic.
- Stable objects in the environment should be used as reference points.
- A change of classrooms should only be required when special equipment or facilities are needed.

The third sub-area was referred to as the ultimate level.

- Since all activities at this level are specialized there will be a different space for each activity.
- To avoid injury and inconvenience, equipment must be stored at each class activity.
- The child must be introduced into complex transitions, provided that the cue structure of that transition remains the same as before.
- The child must be allowed to include the outside environment in his mobility training.
- Supervision of the child is no longer required in his familiar non-formal environment, in fact private space should be given him.
- Even in private spaces, supervision should be within calling distance.

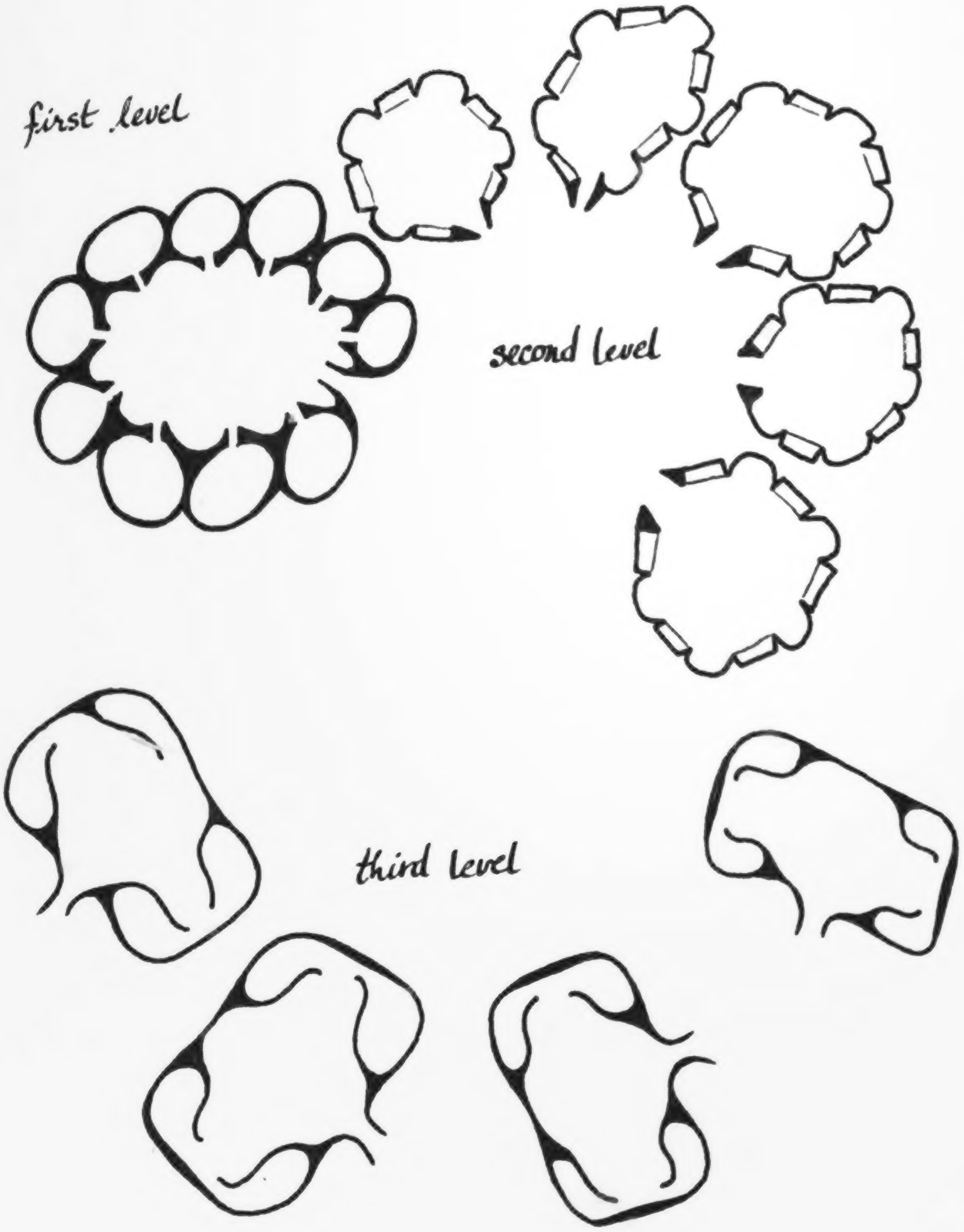
- The environment should be structured to take advantage of all potential sound and touch cues.
- Activity spaces should be more oriented towards group activities, although provisions for individual work should be available.

Form Solution: The diagram for D actually encorporates three diagrams. The first represents the lowest, or beginning, level of blind child development (actually intensive care). The second is an undefined middle level of development, while the third is the most advanced level.

The first diagram indicates a cluster of formal areas that surround an informal area. This area is also used for transitons, but should be so structured as to avoid congestion. All blind child transitions are internal to this cluster, with the exception of those supervised transitions that go outside to therapy, etc. Activities occur anywhere within the formal area or the informal area, and are under continual supervision.

At the second level, the formal areas are no longer tightly clustered, rather they are loosely arranged together. The simple transitions are from one to another, but are minimized to avoid congestion and cross traffic. Those transitions to a separate informal area or a therapy area are simple and direct. Each blind child is assigned a location to work at and store big objects, though he remains under constant supervision and observation.

The third level is even more loosely structured, with the formal areas bearing no apparent relationship to a common area or circulation system. The transitions are comparitively complex with the formal areas themselves providing a loose cue structure. Transitions to informal areas and therapy areas are consistently complex too. The formal areas themselves are mainly structured around group situations or activities, though each blind child is assigned a personal work and storage space for the objects he uses. He is supervised and observed when he participates in group activities, but is only observed casually when he desires to work within his individual space.


first level
second level
third level

REQUIREMENTS:

16. A blind child's communicating with others often interferes with their individual study.

23. Because a child's attention easily dwindles in a prolonged activity, he often becomes restless and seeks diversions.

27. If other children are outside immediate reach, a blind child has difficulty establishing and maintaining communication and social interaction.

33. Non-academic movement and talking by blind students hamper a teacher's control of a class.

42. If children are forced into a new activity before their interest in another activity is exhausted, they will often resist starting the new one.

44. If a blind child with undeveloped muscular coordination is denied constructive opportunities for physical exercise, he will not learn to restrain his uncontrolled movement.

52. If a mentally-handicapped blind child does not sense physical danger, he can easily injure himself through his uninhibited movement.

53. Excessive supervision of an activity provokes a blind child into reacting against the supervision rather than responding to the activity.

57. Because a hyperactive child releases his energy vigorously, limiting his actions will frustrate him.

58. Because a hyperactive child often releases his excess energy without regard to its effects, he disrupts his own or others' academic tasks.

65. When a teacher-therapist must devote time merely to keeping track of students, his instruction will be sporadic.

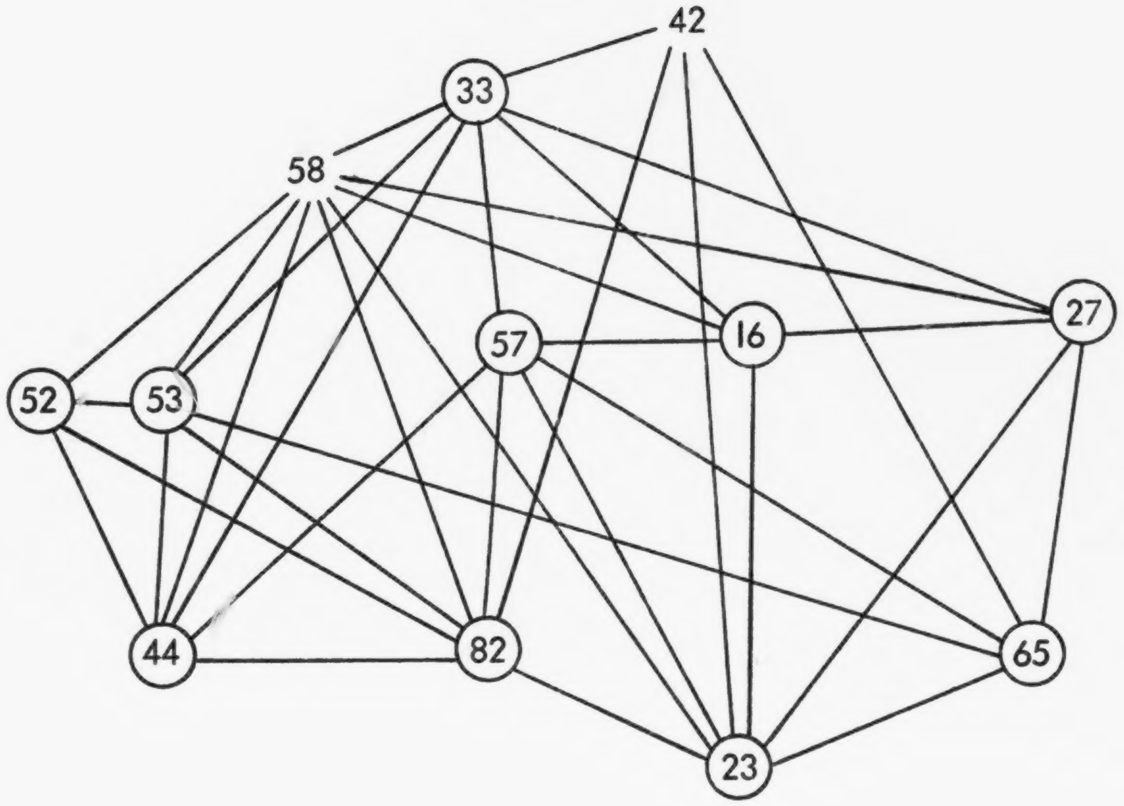
82. Without outlets for physical energy, children will willfully damage or destroy objects in order to vent their frustrations.

Relational Topic

E

This subsystem deals with the problems of communication within physical and academic activity and the relationship between these activities.

Lattice


42
33
58
57
16
27
52
53
44
82
65
23

Discussion

The requirements of this subsystem were interacted by discussing each requirement individually and then in two dominant subsets.

16 -- This requirement immediately points out a paradox of the subsystem. Group activity on the one hand necessitates easy, clear communications between the children themselves and with their teacher. But easy communications at the same time encourage interruptions and unnecessary conversation, making both group and individual study difficult. Providing controllable communication will be a difficult problem.

23 -- Several things are suggested by this requirement. First, that activity length should generally be gauged by the children's ability to control restlessness; second, that form may be able to help focus the children's attention on the groups, the teacher or the work area and third, that the form could provide constructive, temporary "diversions", which would relieve the child's restlessness and return him to the activity.

27 -- A condition for successful communication is physical proximity. This seems as much a misfit as a requirement, since the children will not be able to function in normal society without overcoming such a need. Therefore the solution must try to overcome this need.

33 -- The interpretation of this requirement will vary with the class' age level. Among young children there will be little distinction, if any, between academic and non-academic movement and talking. In the more structured classes , behavior will be more formalized. This indicates that the different age or ability levels will have correspondingly different types of control.

42 -- This indicates a solution in which class length and program are flexible, with control determined by the teacher-class response. In the younger children's classes this would mean a one-room one-teacher situation.

44 -- Many opportunities for constructive physical exercise can be provided. Most physical handicaps should be treated by formal physical therapy, but informal approaches should be tried. Other psychological learning will go on in physical games and play, and informal activity may avoid stressful situations. Informal situations are more likely to form behavior models which carry over in similar group play or activity in normal society.

52 -- Dangers should either be removed or be fairly evident. Injury resulting from exploration is more likely to develop fear and passivity than caution, thus inhibiting learning. Injury should therefore not be a matter of course.

53 -- Suggested here is a physical form approach to supervision. If the physical form can provide safety and can stimulate certain activity, it would be preferred to human supervisoin where possible. The children are less likely to recognize physical form as a limiting control, as well as to have emotional conflicts with it. In turn, the therapist has more time freed for positive teaching and counseling. In academic classes form control of moving and talking would be particularly valuable.

57 -- The hyperactive child will have to learn to control his energy and withstand the frustration in order to function normally. Mental therapy can be supplemented by physical controls and outlets which will help the hyperactive learn, release tension and become more manageable and less disruptive in the class. In order to be helpful in the short run this therpay will have to be closely connected to academic activities so that the teacher can easily remove the uncontrollable child to a therapeutic environment.

58 -- This requirement suggests that academic activities must have provision for the release of excess physical energy in non-interruptive forms. This provision will have to be accessible to the teacher.

65 -- "Keeping track" of students can be accomplished by a) spatial structure; b) additional human supervision. The problems of the blind teacher must be solved as well.

82 -- This necessitates informal outlets which are always available to the children.

Requirements (44-52-53-57-58-82) examined together show that physical exercise can:

a) tranquiliaze by releasing physical and mental tension.
b) promote learning coordination helpful to mobility.
c) effect interaction within the groups through competitive, cooperative games.
d) maintain muscle tone and health.
e) possibly offer success meaningful to the child.

In terms of the subset, these are important as aids to improved performance in class activities.

Requirements (16-23-27-33-42-65) are concerned with the need for communication in activities and the simultaneous prevention of interruption and distraction. As a whole, these requirements provide the basis for connecting physical and academic activity.

Solution Statements:

1. Minimize non-academic moving and talking.
2. Restrain or allow for uncontrolled movement.
3. Prevent injury from uncontrolled movement.
4. Provide outlet for physical and mental tension available during class and free-time.
5. Provide flexibility to allow for various types of physical handicaps.

6. Promote communication in groups.
7. Provide teacher with quick access to all students.
8. Help focus attention on group activity.
9. Allow flexibility in length and type of activity.
10. Provide for separate study by individuals.
11. Provide for varying numbers in classes commensurate with level of ability and nature of activity.
12. Provide physical safety.
13. Allow informal physical therapy and mental therapy to overlap.

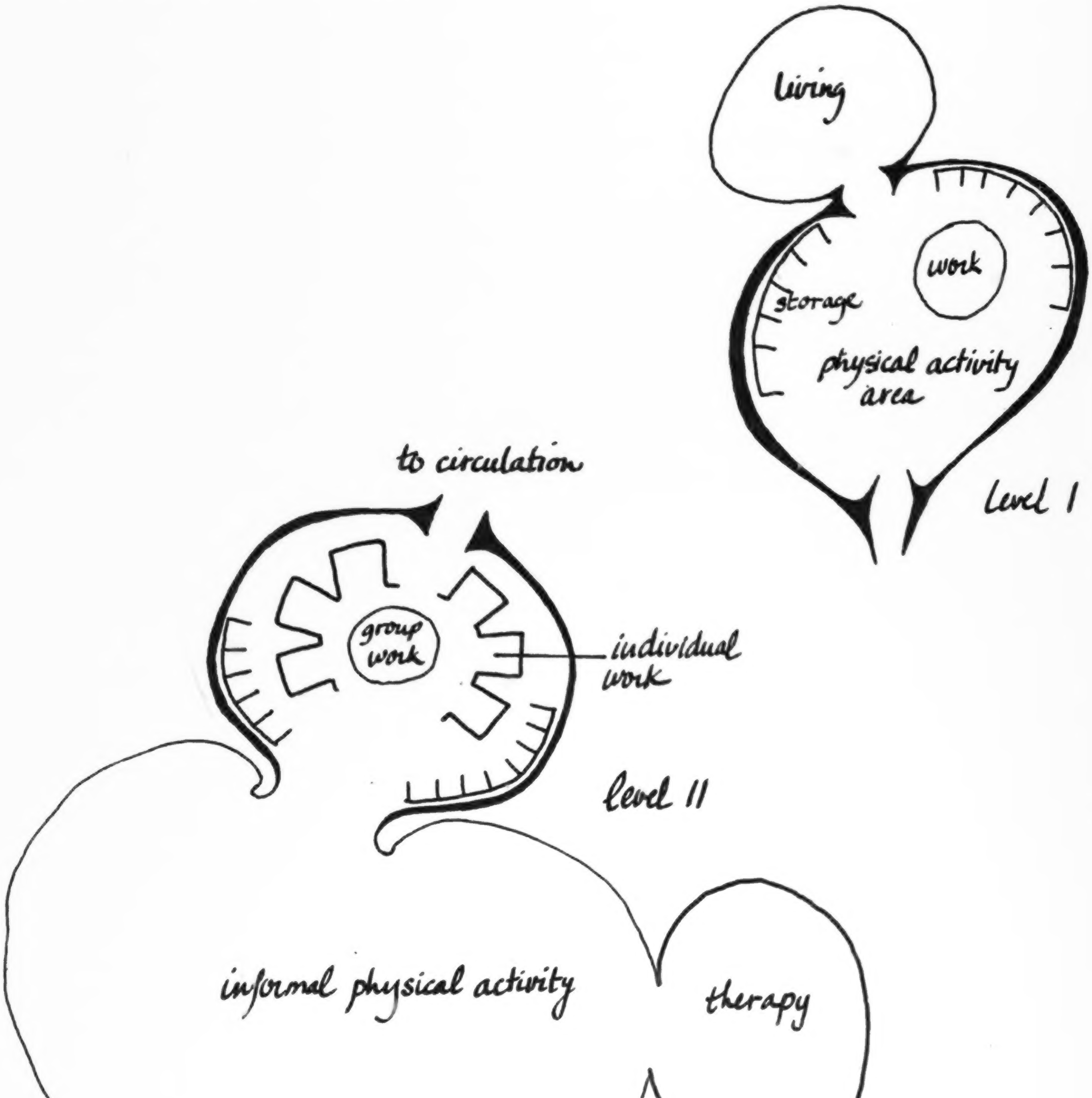
Form Solution: The nature of the class and physical activity space structure varies with levels of competency. For convenience sake only it is diagrammed at two levels and examined at three levels, but it should be considered as approaching a continuum.

Level I: At the level of the youngest and least capable children the activity space is the least apparently structured. These children cannot deal with more than simple tasks mentally and are the most subject to emotional damage. Therefore the activity space is closely integrated with the sleeping and eating space, and therapy goes on during the whole day. It consists of basic learning free from excessive emotional demands, such as handling objects unsystematically to learn how to explore tactually just as children speak syllables of nonsense before using language. The living space and activity space should be divided to prevent their functions from interfering with each other -- modeling clay on the beds, etc. but movement between them should remain free to give the teacher flexibility in his scheduling of nap time, eating and length of activities.

Within the activity area will be needed work surfaces capable of handling group endeavors with space for each child, storage for both students and teachers and room for active play. The students should have as much responsibility for their own tools and toys as possible. Their own storage to which they return them, for example. The control of external noise and light should be with the individual teacher. Since the teacher will probably be able to best take care of approximately three to six children, the size of the space, work and storage areas should be in scale with this number. The space should be as safe as possible, and should provide the child with relatively simple stimuli. This does not mean it should be so unstimulating as to encourage vegetation, rather that the forms, textures, locations, etc., should be readily perceivable and memorable.

Level II: The child's progress should be reflected by the space. As he does so he can participate more in group efforts as well as in individual projects; he demands less immediate supervision and his physical development can be separated from intellectual development. At this intermediate level the space is divided into academic work and informal physical activity areas. In the first are work surfaces, storage, noise and contact controls for both group and individual study. In the second, accessible to another class or two and to mental therapy, is safe, noise-controlled equipment. Both have more stimuli, require more decisions to get to and operate in, require more cooperation in a group and so on. Movement between the spaces should occur freely when the child needs physical release. The child also will begin to receive formal physical therapy which concentrates on his peculiar problems. This therapy will constitute a separate activity and space.

__Level III:__ In the ultimate phase the child is very self-reliant. He can pay attention, restrain his ego drives, is fairly coordinated and responsible. He needs fewer physical forms to attain these achievements, so they are removed. The class becomes ordered by understood and accepted mores or rules of conduct. It becomes larger and the learning more complex. The student can subordinate himself to operate in the group but can do independent work. He has more control over his own entrance and exit, his own storage and materials.


living
work
storage
physical activity area
level I
to circulation
group work
individual work
level II
informal physical activity
therapy

REQUIREMENTS:

1. When unable to determine his location by familiar reference points, a blind child will be insecure in his movements.

4. Because a blind child mentally notes a specific location for an object he frequently uses or encounters, he becomes confused if he finds the object has been moved or a different object is in that location.

6. Because a blind child must concentrate, mentally and physically, in order to cope with his immediate environment, he is often fatigued by physical tasks.

10. Objects with similar forms and physical properties but different in purpose or intent are confusing to a blind child.

15. Objects without a unique characteristic are difficult for a blind child to remember.

17. The introduction of sounds irrelevant to an activity will confuse a blind child if he is dependent on the sounds of the activity to guide his participation.

24. Objects without familiar qualities are difficult for a blind child to identify and use.

29. When a change in activities necessitates a change in location, the time spent moving is often non-productive.

30. A blind child's difficulty in pin-pointing the locations of objects not in use hampers his ability to find objects outside immediate reach when they are needed.

40. When a blind child must concentrate on his immediate environment and destination, simultaneous participation in another activity is difficult.

45. If a child is denied individual control over things he feels are his, he often develops a possessive attitude toward the property of others.

46. Because hyperactive children are often unable to discern pertinent stimuli, either they fail to react to important stimuli or they react to all stimuli equally.

54. If a blind child must explore an object or situation at length in order to identify it, his reaction to it is often delayed.

65. When a teacher-therapist must devote time merely to keeping track of students, his instruction will be sporadic.

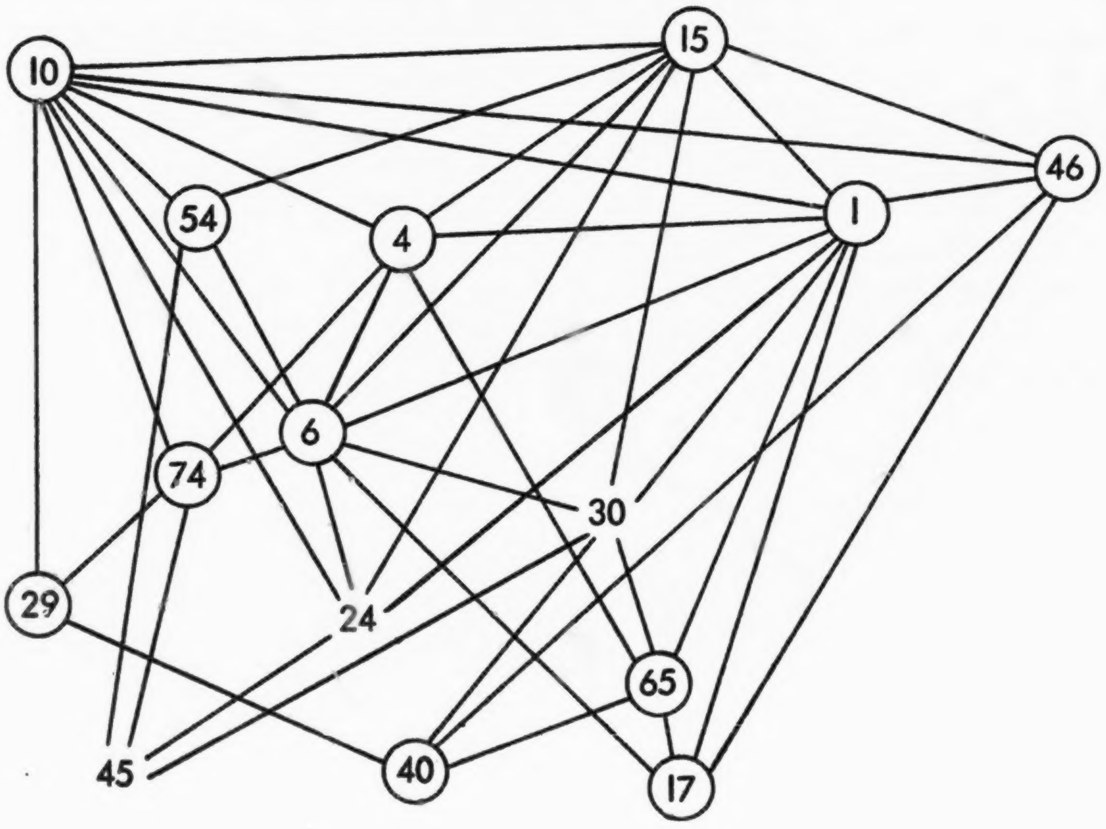
74. If materials or movement necessary to effect an activity cannot be applied without disruption or delay, teacher-therapists often disallow the activity.

F

Relational Topic

This subsystem deals with the capacity of the blind child to orient himself relative to locations, objects, and other stimuli. These orientational problems strongly influence the organization of teaching-therapy situations and the more general cue structure of the blind child's environment.

Lattice



Discussion

This subsystem of fifteen requirements had fifty-four interactions. Due to its complexity, the more 'conventional' system of breaking down the interactions into relatively uncomplicated simplex lattices was abandoned. A system was used in which the individual interactions were examined and 'avoid' or 'provide' statements were written. These statements were primarily grouped according to physical pertinence and then grouped according to basic similarities and content. These solution statements were then analyzed by groups and then physical implications were stated. A final level of solution statements was derived from this list based upon specific areas of consideration in order to produce a single conceptual idea of the necessary physical form relationships.

Following this procedure, the 'avoid-provide' statements are listed first. Since there were 129 of these statements, only a few are included here because of space limitations. They are, as follows:

- Avoid orientation cues which are moveable (1-4).
- Avoid orientation cues which can't be located in a crowd (1-6).
- Provide orientation cues that can be used without availability of blind child's hands (1-6).
- Avoid patterned activities, which may not be available, as orientation cues (1-10).
- Avoid objects which must be carried with both hands (1-6).
- Provide reference points which have unique characteristics (1-10).
- Avoid reference points which are too similar (1-10).
- Avoid overly differentiated environment, where one structure has no relationship to another as part of an easily comprehensible larger system.
- Avoid orientations based on environmental cues which will be only intermittently available, i.e. the basic structure should be permanent.
- Avoid situations where one type of object might be moved to another location.
- Provide enough objects in each location where they might be used so that they do not have to be borrowed from another location.

The solution statements derived from these are listed next. Since there were 58 of these statements, only a few are included. They are, as follows:

- Any object that a blind child might carry must not restrict his mobility skills (6-1, 6-30).
- If a secure storage area is not available for a blind child's personal items, they should be clearly identified as his (45-24, 45-30, 45-54).
- All objects should have quickly identifiable characteristics (15-4, 15-6, 15-24, 54-4, 54-30, 10-4, 10-6, 46-15, 46-54).
- Non-descript objects may be identified by the task they are used in or where they are stored (54-15, 54-74, 10-24, 10-74).
- An environment is called for where the orientational cues are permanent and where the structure of the cues in any one sub-part is easily relatable to the rest of the cues in the total structure.

- Each type of object should be kept in one location only. If this is impossible, then locations where the same object might possibly be used should be kept close to each other. Furthermore, adequate numbers of objects, and storage for them, should be provided in each of these locations.

The solutions implications of these statements are listed next. Since there were 43 of these statements, only a few will be included. They are, as follows:

- Locations should be avoided where objects used in one location would be readily left in another location. Such object misplacement will occur when one use space serves a variety of object uses, when one storage area serves a variety of use areas, or when objects to be used in one task are in widely scattered locations.
- Thus every use area should be served by its own immediate storage area when the blind child needs and utilizes the objects. This avoids moving objects great distances.
- The object storage-use locations must be arranged so that their function and locations are easily identifiable. On the scale of the use area, objects and their locations must be easily identifiable.

The final solution statement is listed next, as follows:

For any natural object-activity compliment, use and storage area must be almost synonymous, with hard to move objects permanently fixed in place. The synonymous use-storage areas must not be used by a variety of blind students, and each must be adequately stocked so that others do not have a need to borrow objects from it. One use-space should not serve a wide variety of object uses -- implying there would be more than one object-use area for each individual. Thus each individual would have a number of use spaces all his own, with each one in the surroundings of major supporting equipment for the different activity types.

Boundaries between the individual areas must be rapidly and clearly perceivable, as must ownership and access rights. An individual's objects must be able to be left out and undisturbed if his progress on a project is interrupted.

The individual use areas should be combined into small group areas with some degree of acoustical isolation from other small group areas, in which the blind child can move freely from one area to another under supervision by teacher-therapists.

Because of the exposure to the activities of other blind students, the transitions, whether between smaller object-use areas or larger activity areas, should have a high potential of educational benefit.

The transition structure and orientational cues must be such that a blind child in motion will not disrupt other organized activities or unduly fatigue himself. The perceptual environment must have a basic permanent skeleton of reliable orientational cues which can be quickly identified without the use of hands. Combined with the basic skeleton is an enriched set of cues telling the blind child pertinent information about his location. Having objects in their use-areas helps facilitate this task, as would non-ambiguous sounds which are part of, and do not distract from, an activity in a given area.

Human congestion must be avoided as must sounds and shapes which would destroy acoustical orientation.

The structure of the cues in any one sub-part must relate to the rest of the cues in the total structure, requiring some similarity between the normal sighted world and the structure intimately used by the blind child. Emergency aids must be extremely easy to locate and operate.

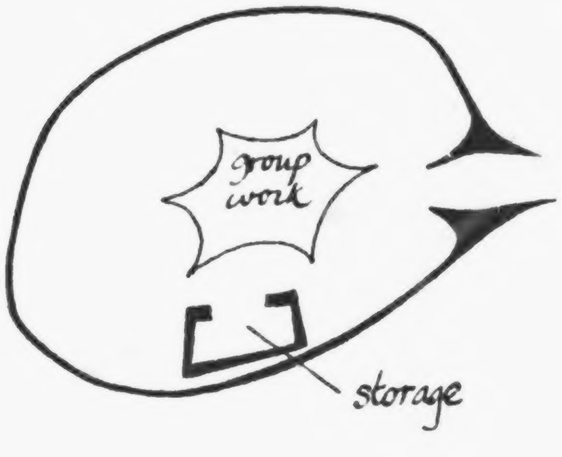
Counter-indications to the above: The hyperactive blind child must have discrete exposure to the enriched aspect of the above orientational cue structure.

Final Form Solution: The following is a discussion of the three form diagrams for this subsystem. Although there are three different diagrams, the blind children should have a continuum of different areas that would suit their developmental needs.

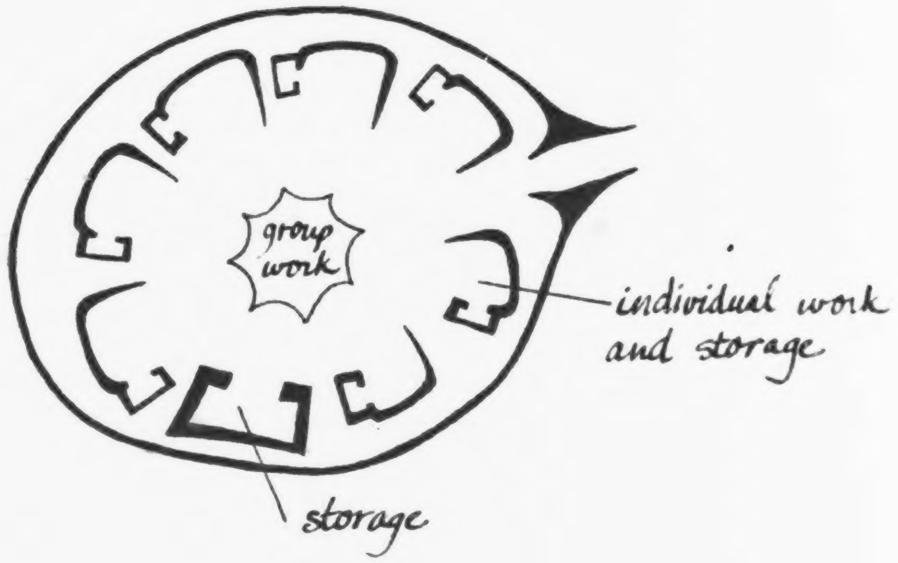
The first diagram (1), for the lowest developmental level, represents an area that is completely supervised at all times with access controlled by the supervisor within the area. This supervisor accompanies the class as a unit during transitions that are complex. There is a central storage area for all objects that is administered by the supervisor. The work areas are nonpersonal since the blind child will not conceive of an individual work area at this stage and therefore will be allowed to work where he pleases. The work area must be sufficient for all the blind children to work at once.

The second diagram (2), for the intermediate developmental level, represents an area that is also completely supervised at all times with access from other areas and transition spaces controlled only by the nature of the entrance. The transitions at this level are semi-supervised, noncongested and occur in a simple layout of transition spaces. The blind child is given both personal storage and storage for class objects that he may be using. There is also group storage for class objects, therefore the individual's storage need not be very large. The personal storage areas should be secure since other classes may occupy the same room during other periods. The group work area at this level is personal with sufficient space for the blind child to carry out tasks. The same blind child will always use the same work space.

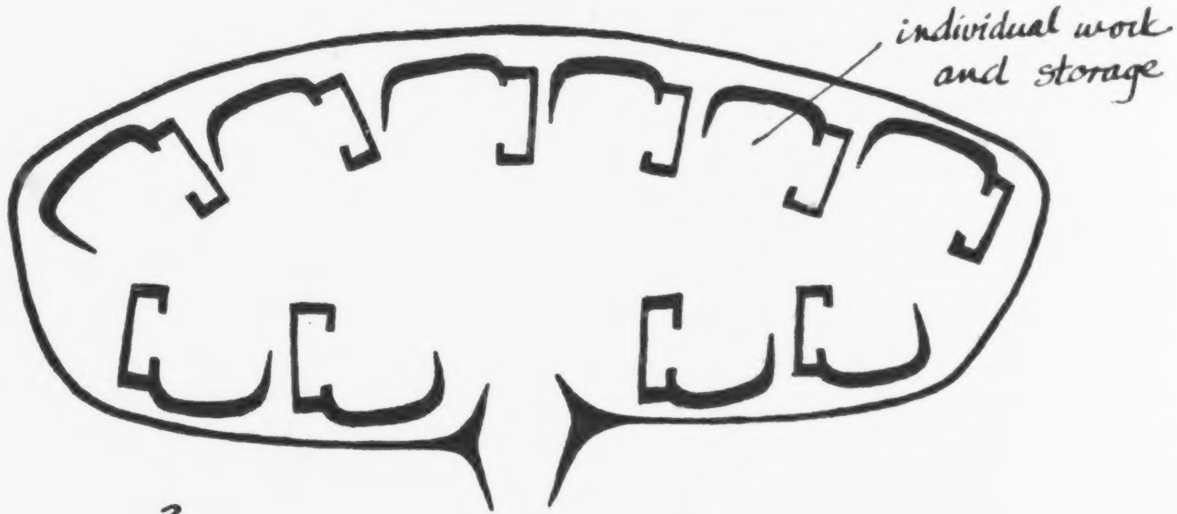
The third diagram (3), for the highest developmental level, represents an area that is also completely supervised at all times with access controlled by the nature of the entrance. The transitions at this level may be as complex as the blind child is capable of handling. He also has personal storage and storage for class objects at an assigned work area. There is little if any class storage or group work at this level.


group work
storage

1.


group work
individual work and storage
storage

2.


individual work and storage

3.

REQUIREMENTS:

1. When unable to determine his location by familiar reference points, a blind child will be insecure in his movements.

5. Because a blind child explores his environment actively, through touch, he often feels insecure in his movements when that environment is unfamiliar.

7. When a blind child knows his activities are continually supervised, he does not develop self-reliance.

12. When a blind child's practice in mobility and orientation is restricted to a known environment, he becomes confused and insecure in a new or changing environment.

26. Confusion and insecurity in an unfamiliar environment often inhibit a blind child from seeking aid.

47. If a child is denied opportunities to make simple choices, he is hesitant to act when faced with decisions.

51. If a blind child is compelled to learn or react at a rate not suited to his abilities, he will become inattentive or resistive.

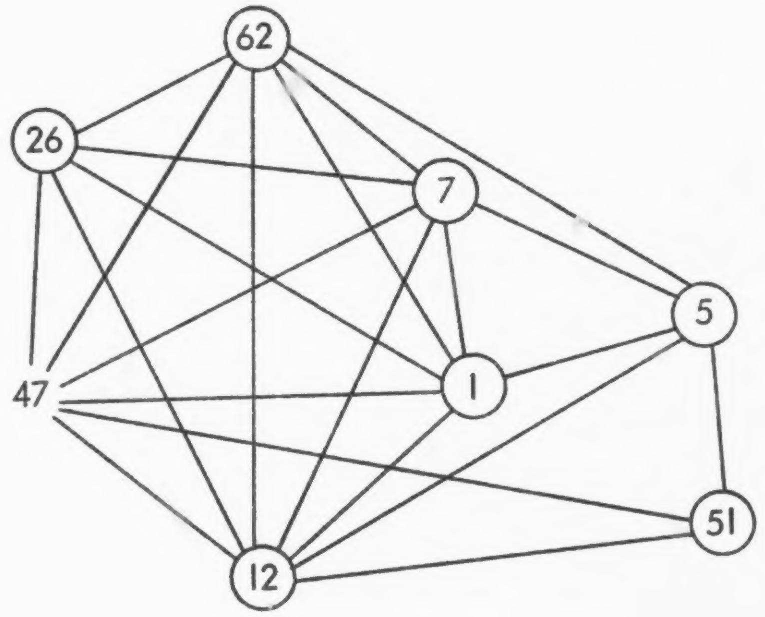
62. If a blind child loses his way, he often does not know where or how he erred.

G

Relational Topic

Subsystem G deals with the overall environmental organization of the blind child's activity routine and the judicious use of supervision within this environmental organization.

Lattice



Discussion

The structure of subsystem G consisted of a six-way simplex (requirements 1, 7, 12, 26, 47, 62) as its root and was modified by two additional requirements (5, 51). Since the structure was so tightly knit, the solution to it was arrived at by considering three links at a time -- small simplexes of three requirements. By considering all twenty-eight of these contained within the structure, individual solution statements were arrived at for each one, and then combined together to determine the physical and organizational form of the system.

A brief discussion of certain terms used in the statements follows:

Environmental relationships: An environmental relationship is a relationship between objects which appear constant throughout an environment. For example, in a normal environment, all intersections have certain consistent relationships about them: There is the relationship of a crosswalk to the corner or the relative placement of a stop sign. How the corners of a room relate to its size and shape can also be understood as an environmental relationship. Further, the relationship between an entry way and the placement of a light switch, or the placement of a handrail relative to a flight of stairs would be considered relatively continuous within an environment.

Familiar environment: A familiar environment is an area, space or territory that is directly known to the blind child such that he knows where one object is relative to another. This does not refer to the more general type of familiarity known to the sighted. That is, because a blind child may live in a dormitory does not necessarily mean he is familiar with the dormitory in general, for being blind he may only know the part he has had direct contact with.

	Solution Statements:	Reference(simplex) :	Index
1.	Blind children must learn to cope with unfamiliar environment without the aid of supervision.	(1,5, 7)	O, S
2.	A blind child is to be exposed to unfamiliar environments at his own rate.	(1,5,7) (5,12,51)	O
3.	A blind child is to have access to new environments in which he will be the source of his security.	(1,7,12)	O, S
4.	There is to be a consistency between reference points in the familiar and unfamiliar environments.	(1,26,62) (12,47,62)(1,7,26)	O, R
5.	The more difficult it is for a blind child to distinguish environmental relationships the greater his supervision should be.	(1,7,26)	R, S
6.	Supervision is not to interfere with a blind child's choice of whether his mobility practice is to be in a familiar or unfamiliar environment.	(1,7,47)	O,S,C
7.	A blind child is to develop an understanding and ability to use environmental relationships.	(1,7,62) (7,12,62) (12,26,62)	R
8.	The familiar environment must not be specially structured.	(1,12,47)	R
9.	A blind child is to have choices between familiar or unfamiliar environments.	(1,12,47) (12,47,51) (12,26,47) (1,26,47)	O, C

		Reference(simplex):	Index
10.	A blind child should never be without choices to make.	(1,47,62)	C
11.	A blind child is to have experience and practice in unfamiliar territory without supervision.	(5,7,12) (7,12,62)	O,S
12.	A blind child is to have unsupervised experience in familiar territory.	(5,7,62)	O,S
13.	A blind child is to experience supervised and unsupervised unfamiliar environments.	(7,12,26) (7,12,47)	O,S
14.	Supervision is to be an aid chosen by the blind child. (It should not be forced upon him).	(7,26,47) (7,26,62)	C
15.	Aid should be easily available if he needs it.	(7,26,62)	C,S
16.	A blind child should be unaided by supervision in unfamiliar environments.	(7,47,62)	S
17.	A blind child should not be allowed to make only those choices in which he will be supervised.	(1,7,47)	C,S
18.	A blind child should be able to work problems out alone if that is his choice.	(26,47,62)	C

In the solution statements the following categories appeared distinct within the context of the subsystem:

C - forms dealing with blind child's choices.
O - forms dealing with the environmental organization.
R - forms dealing with environmental relationships.
S - forms dealing with supervision of the blind child.

In the following, these categories are discussed singly in an attempt at solving for all the statements contained in them and are subsequently combined into a final form solution of the total subsystem.

Category C: Choice: The blind child should be free (unhampered by supervision) to make choices between familiar and unfamiliar environments. However, these choices should not allow him to remain predominantly within a supervised environment. He must also be free to rely upon himself in a stress situation rather than having aid thrust upon him.

Category O: Environmental organization: For mobility training and practice, the blind child must have an unfamiliar environment that is both supervised and unsupervised and a familiar environment that is unsupervised. Practice and training in these environments should take place at his own rate. There should be a consistency of relationships throughout all these environments. The exact form solution to this cannot be arrived at, however, until an interpretation of a "blind child's own rate" can be made.

Category R: Environmental relationships: There can be no specialized environment containing special relationships. For example, if a blind child is to experience swinging doors in a normal unfamiliar environment, swinging doors must be included within his familiar environment. Since tables and chairs are movable as normally experienced, a blind child must experience them in a movable context -- they are not to be fixed rigidly in one place. If a blind child has no understanding of these types of environmental relationships (too young or mentally retarded), he should be under constant supervision until he can be exposed to unsupervised environments at a rate proportional to his capabilities and understanding.

Category S: Supervision: The blind child must have given destination points to use in order to perform a daily routine. The points should be situated in such a way that in order to get from one point to another, the blind child will be forced to experience all the necessary environments: familiar/supervised; familiar/unsupervised; unfamiliar/supervised; unfamiliar/unsupervised. Therefore, supervised areas should be separated by unsupervised areas. The exact sequence of destination points should be determined by the degree of a particular child's understanding.

Combination of C and O: Category C deals with choices between unfamiliar and familiar environments and the freedom of these choices. Category C gives us the interpretation of "the blind child's own rate" that we needed in order to solve Category O. Under this interpretation, "the blind child's own rate", means the rate which he chooses. The blind student is therefore able to move from familiar environment to unfamiliar environment as he chooses; similarly, he can move from supervised to unsupervised environments at will. These choices of mobility are his and he is free to choose any of the combinations as stated in S. Environmental relationships must be constant throughout each of the combinations of environments.

Combination of C and O and S: The solution of S considerably modifies the solution of C and O by requiring that the blind child be forced to move from one place to another; thus implying that the free choice indicated in O and C must be somewhat restricted. Therefore, the complete free choice in O and C must be replaced by freedom of choice within a given routine structure; i.e. he must be free to choose the path to a required destination

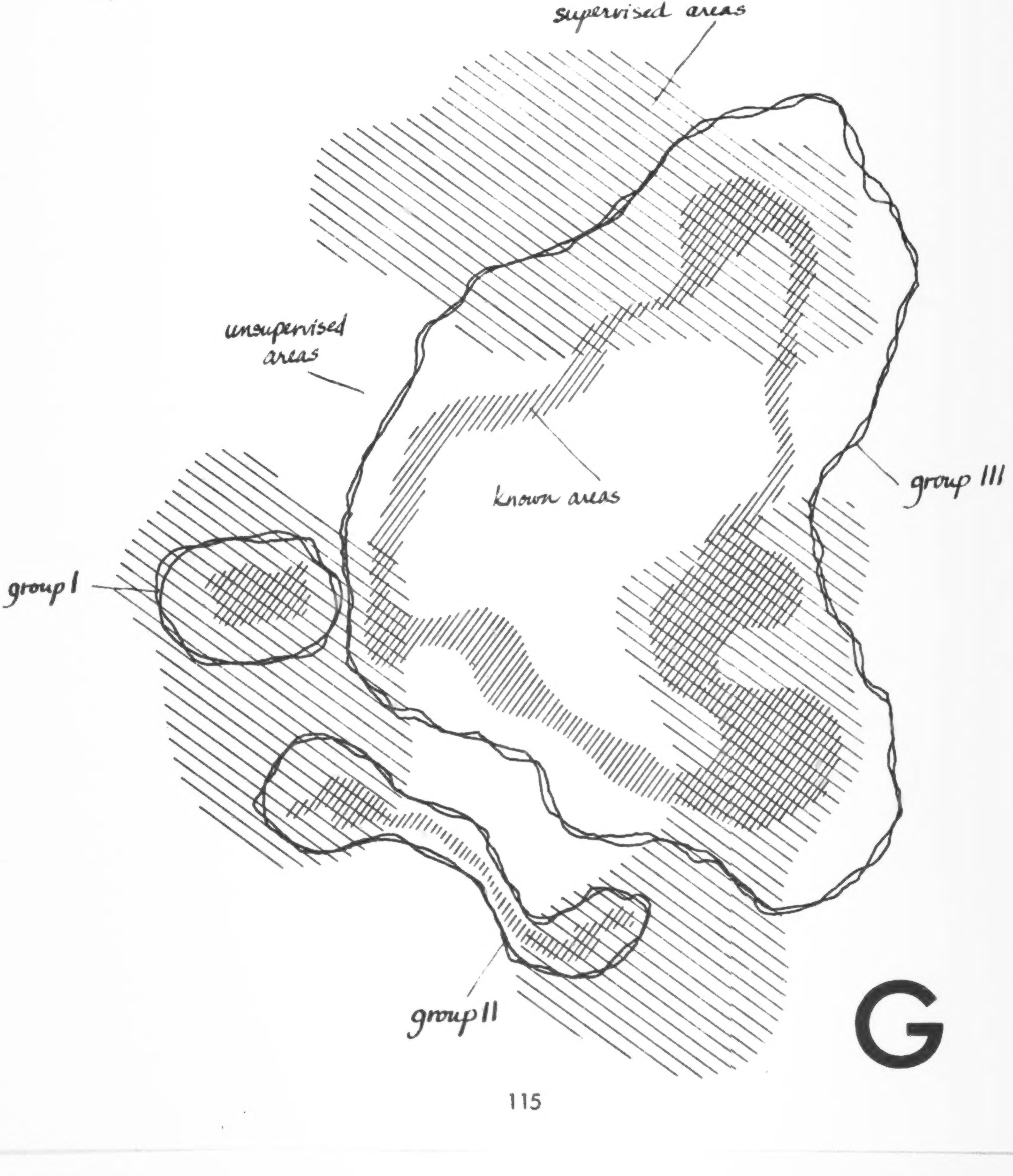
Final Solution: Combination of C, O, R, S:

Supervised areas must always be separated by unsupervised areas so that in moving from one supervised area to another, the blind child is forced to move through an unsupervised area. Depending on the advancement of his understanding of relations, each blind child will have a particular set of destinations which he will be required to use in his normal course of action. These destinations will be ordered in such a way that he will experience all types of environments (supervised/familiar, supervised/unfamiliar, unsupervised/familiar, unsupervised/unfamiliar) by moving from one destination to another. (For greater control, he may have to reach destinations in a set order).

In getting from one destination point to another, the blind child must be free to choose any path he wants. It is important that he get from one destination to another with a determined routine, but it is equally important that he be allowed some choice in this selection.

The blind child's familiar environment must not be specially structured. That is, his familiar environment must consist of the same elements and relationships that he will find in an unfamiliar environment.

Until the blind child has some working knowledge of environmental relations, he should be continually supervised. As he develops an understanding of relations, he should be exposed to unsupervised environment at a rate suitable to his individual capabilities.


supervised areas
unsupervised areas
known areas
group III
group I
group II

G

REQUIREMENTS:

31. Attempts to ensure a blind child's safety by means of close supervision infringe upon his privacy.

34. If a blind child is made to feel dependent on either mobility aids or on patronizing people, he may develop a defeatist attitude about his becoming self-reliant.

36. When physical involvement does not accompany a verbal description of a physical organization or process, a blind child's conceptual image of the process or organization is often distorted or incomplete.

38. If a blind child is not allowed to gain experience outside his customary environment, his dependence on that environment is increased.

53. Excessive supervision of an activity provokes a blind child into reacting against the supervision rather than responding to the activity.

56. Since a blind child's fragmented perception --of parts rather than wholes --does not show him immediately which parts are potentially dangerous, he will hesitate to explore an unfamiliar environment.

59. When a blind child's needs and desires are catered to preferentially, others around him will often become jealous and/or condescending.

72. If a child can discern no practical application for what is being taught, he will lose interest in it.

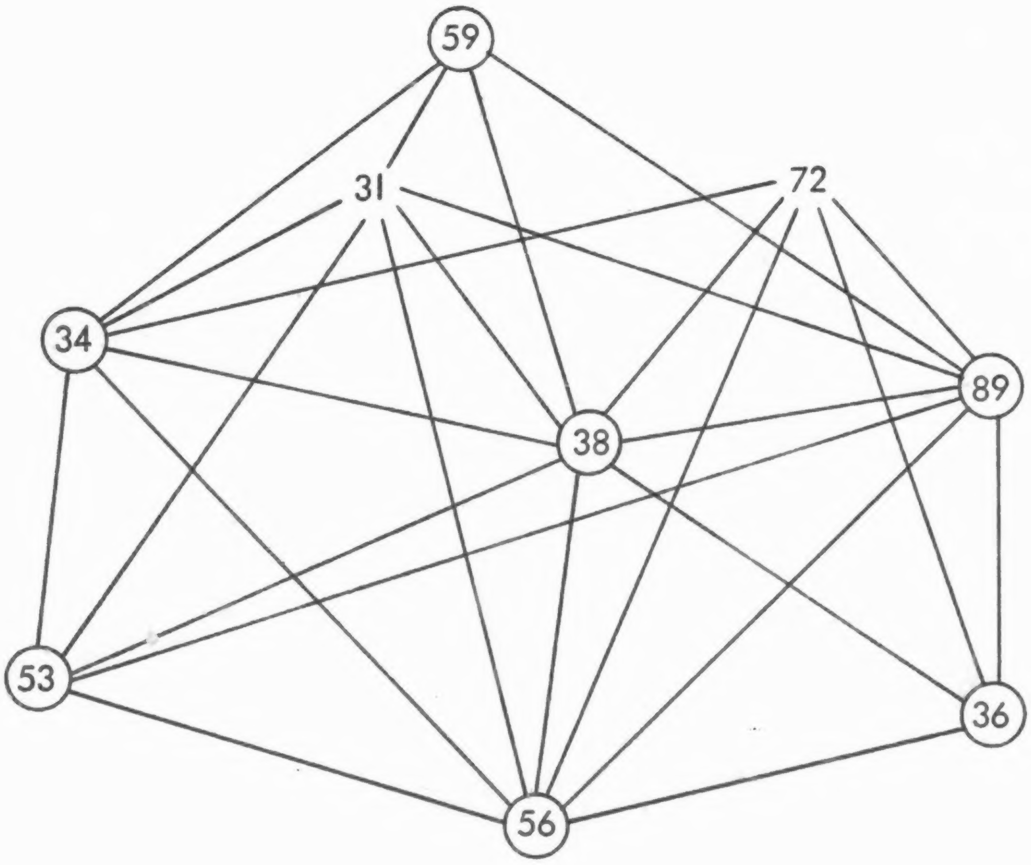
89. If a child's "free-time" is completely unstructured or unsupervised, he often lacks initiative to develop extra-curricular interests.

H

Relational Topic

This subsystem deals with the blind child's use of free time and the structuring of his environment to allow unsupervised exploration within a supervised system.

Lattice


59
31
72
34
89
38
53
36
56

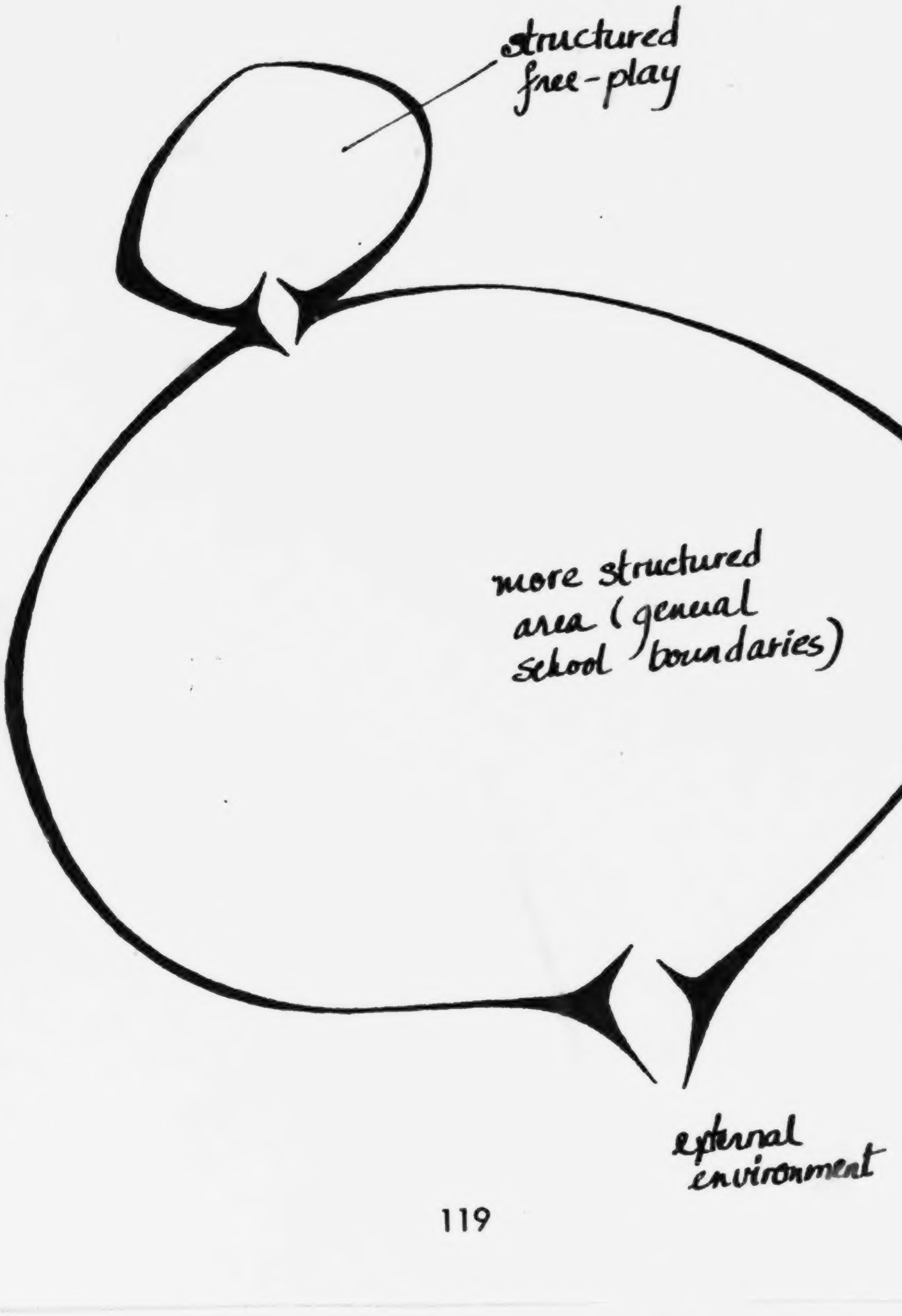
Discussion

By examining all the interactions of subsystem H, the following solution statements or form implications were derived:

1. (31,56) A blind child should learn to get along in unfamiliar environments without close supervision.
2. (31,89) A blind child's free time should be supervised minimally -- only to effect the proper use of free time.
3. (31,59) Blind children who need continual supervision must be separated away from the rest of the blind children who do not.
4. (31,34) Supervision for a blind child must be kept to a bare minimum.
5. (31,38) A blind child should gain experience outside his customary environment -- unsupervised.
6. (31,53) (59,89) Activities are not to be oversupervised, therefore a blind child must be allowed personal freedom within activities.
7. (34,72) A blind child should be left on his own, void of mobility aids and people's aid in order to make greatest use of what is taught to him in mobility training.
8. (34,56) A blind child should learn to rely on natural cues for moving through unfamiliar environments rather than using mobility aids or relying on patronizing people.
9. (34,38) The blind child is to be given ample experience unaided in uncustomary environments.
10. (34,59) A blind child must work out his own problems and satisfy his needs alone without being dependent on others' help.
11. (36,38) A blind child must be allowed to have experiences in environments to which he will eventually be exposed.
12. (72,89) (36,89) Structure free time so that the blind child can be familiarized with many organizations and/or processes.
13. (36,56) A blind child is to gain understanding of unfamiliar environments by being exposed and experiencing the gross organizations and processes taking place in it.
14. (36,72) The blind child must be able to find application to the organization to which he is exposed.
15. (38,72) (56,72) A blind child must experience those things in the external environment which he is being taught.
16. (38,53) The blind child is to have an opportunity to experience uncustomary environment alone -- unsupervised.
17. (38,89) A blind child should be able to use his free time to explore new environments.
18. (53,56) A blind child must learn how to cope with unfamiliar environments without the aid of supervision.
19. (56,89) Free-time to be used to explore unfamiliar environments , (in a structured type of activity).
20. (56,89) The blind child's free-time is to be structured and supervised if the blind child lacks initiative to develop extracurricular activities.

21. (38,56) The blind child is to have supervised exposure to unfamiliar environments before he is set loose in it.

Final Solution: By examining the form implications and solution statements and eliminating the overlap, two general physical form relationships are derived. First, the blind child must have free-time in which he can either participate within a structured free play area or in exploration of new environments. This defines an area for structured free play activity; a more structured environment for exploration and an access for the blind child to the external environment. The more structured environment should form the transition between the structured free play area and the access to the external environment. Second, since supervision is to be kept to a minimum and should only be used as an initial guide or check in the blind child's movement to a more complex area, the points of common access should be constricted to allow this supervision and to better define the limits of the areas.



REQUIREMENTS:

7. When a blind child knows his activities are continually supervised, he does not develop self-reliance.

8. If a blind child cannot get help from the teacher when he needs it, he may disturb people around him by asking them for assistance.

9. When a teacher instructing a group of blind children must devote his attention to a single student, the other students will waste time for lack of direction.

39. If a blind child feels that he can escape punishment, he may disrupt activities through lack of self-control.

51. If a blind child is compelled to learn or react at a rate not suited to his abilities, he will become inattentive or resistive.

53. Excessive supervision of an activity provokes a blind child into reacting against the supervision rather than responding to the activity.

60. If teacher-therapists do not know how a child is applying what has been taught, they have no way to assess his progress or potential.

63. When working at a level which produces no sense of accomplishment, a child will seek a level where he can succeed.

89. If a child's "free-time" is completely unstructured or unsupervised, he often lacks the initiative to develop extra-curricular interests.

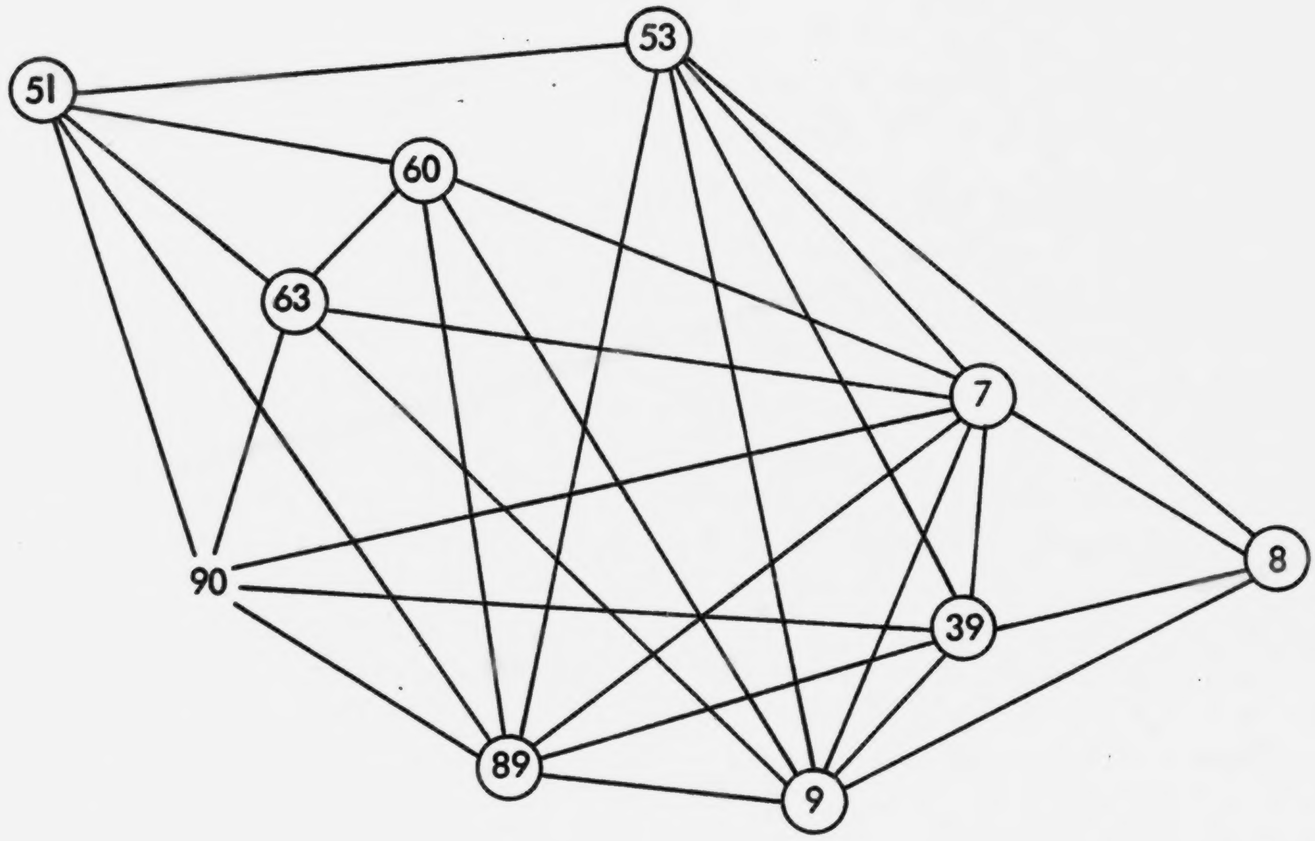
90. If a child cannot avoid an activity, he may disturb or disrupt it by his reluctance to participate.

Relational Topic

This subset deals with supervision and structure of activities, availability of aid, and how these factors relate to the education of the blind child.

Taken from the requirements, the major misfits inherent in this subset are: opportunities for development of self-reliance thwarted by over-supervision; activities disturbed by a child's lack of self-control or by his reluctance to participate in activities; free time wasted by lack of structure or supervision; reaction by blind child against over-supervision rather than response to an activity; activities disturbed by a blind child's inability to get aid when necessary.

Lattice



Discussion

The form implications of individual requirements in this subset are: an area free from direct supervision (#7); immediate access to aid without disturbing others (#8); facilities for individual attention within a group (#9); supervised group activities (#39); available unsupervised free time (#53); communication among staff members concerned with the same child (#60); availability of a choice of activities at the child's success level (#63); free time structured and/or supervised to give a child a start on his work (#89); availability of a choice of activities for the child at any time (#90).

In seeking the most comprehensive form relationships, strongly-interacted groups of requirements must be examined. There are three five-way simplexes in this subset. The relationships dictated by those simplexes are: children should be able to get individual aid without disturbing the rest of the group -- indicates proximity of the child to aid and control over his activity disturbance (#7, #8, #9, #39, #53), and (#7, #9, #39, #53, #60); child should feel that supervision is not restrictive to his actions -- calls for a policy understanding between student and supervisor, and also that the physical form not oppress the child's actions (#7, #8, #9, #39, #53); activities should be structured or supervised such that the child's work will have direction -- dictates supervisional or structural control over the child during the initial stages of an activity (#7, #8, #9, #39, #53); a child should have a choice of activities, varying in degree of structure and supervision -- calls for proximity of those activities, easy access among them and distinction among activities (#7, #9, #39, #53, #89), and (#7, #39, #53, #89, #90).

These simplexes do not include all requirements or interactions found in the subset. Other relationships are to be found either in smaller simplexes or in single interactions. The most important of these relationships are: the child should have a choice of activities, structured and unstructured, which give the child a sense of accomplishment -- calls for either agrouping of children by capability or a grouping of activities by level of activity difficulty (#7, #53, #63, #90); the behavior of the blind child in various activities should be observed and recorded -- calling for areas from which observation may occur and a storage area for records (#7, #9, #60, #89); the child should choose his work level and should be allowed to make this choice as independently as possible -- calls for independent work areas or areas for escape from supervision in some activities (#9, #53, #63); individual aid should be in proximity to all activities -- but not such that disturbance occurs when the child seeks aid (#8, #9, #53); a child's application of his free time should be recorded as a check on his progress (#60, #63); teachers should be able to administer help to a child immediately -- a relatively constant degree of proximity between staff and student (#53, #90); a child's use space should be flexible enough to keep him interested and occupied without special attention (#9, #63); the child should be able to work independently (#7, #9); the teacher-therapist should be able both to supervise a group and to be individually accessible (#7, #8).

By evaluating the above relationships, one can extract statements of what must be solved in order to eliminate the misfits and to satisfy the needs of the subset. The primary solution statements extracted from this subset are:

1. The child must be able to remove himself from direct supervision or structure.
2. When removed from direct supervision the child should be observed but not governed in his activities.
3. When removed from direct supervision the child must have access to and be near to supervised activity.
4. The child must always have a choice of activities in which to participate.
5. Activities should range in degree of supervision and structure from formal to non-formal.
6. The entire range of activities must be easily accessible.
7. The child must be able to receive immediate aid/assistance.
8. Aid/assistance should include counseling, therapy, tutoring, etc.
9. The presence of aid/assistance is necessary at any time and for any activity.
10. The child should go to the aid more than the aid should go to the child (physical movement).
11. The child must be able to receive individual attention without disturbing or halting the progress of the rest of the group.
12. Individual attention must take place apart, but easily accessible from, group activity.
13. Teacher-therapists must be able to supervise a group and to be accessible to individuals.
14. Records of a child's work (accomplishment, failures) must be kept and the child's progress discussed among faculty members.
15. Faculty conference areas should not impinge on student areas.
16. Conference spaces should be centrally located near teacher activity areas.
17. Activities offered to the child must vary in degree of structure and supervision through formal, semi-formal, and non-formal activities.
18. The characteristics of formal activities are: teacher control; class situation; discipline; rigid student-teacher relationship.
19. The characteristics of semi-formal activities are: tutorial in nature; teacher gives direction to activity and then only intervenes when needed or asked for; flexible student-teacher relationship.
20. The characteristics of non-formal activities are: unstructured; teacher observation only; no intervention or discipline, unless necessary; no student-teacher relationship established, even informally.

These solution statements pose many conflicts. To generate a form solution from these statements, it is necessary to examine them relative to one another. If, for example, in a group of children, one of the group members exits from the activity; he will momentarily disturb the activity. The question is one of whether this momentary distraction to the group is critical, since another solution statement implies that group members should not be disrupted by the entry or exit or another student.

The form solution to this problem can be realized in several ways. First, there must be some control of entering and exiting from an activity. This conflicts with the statement that children should have a choice of activities at all times. Second,

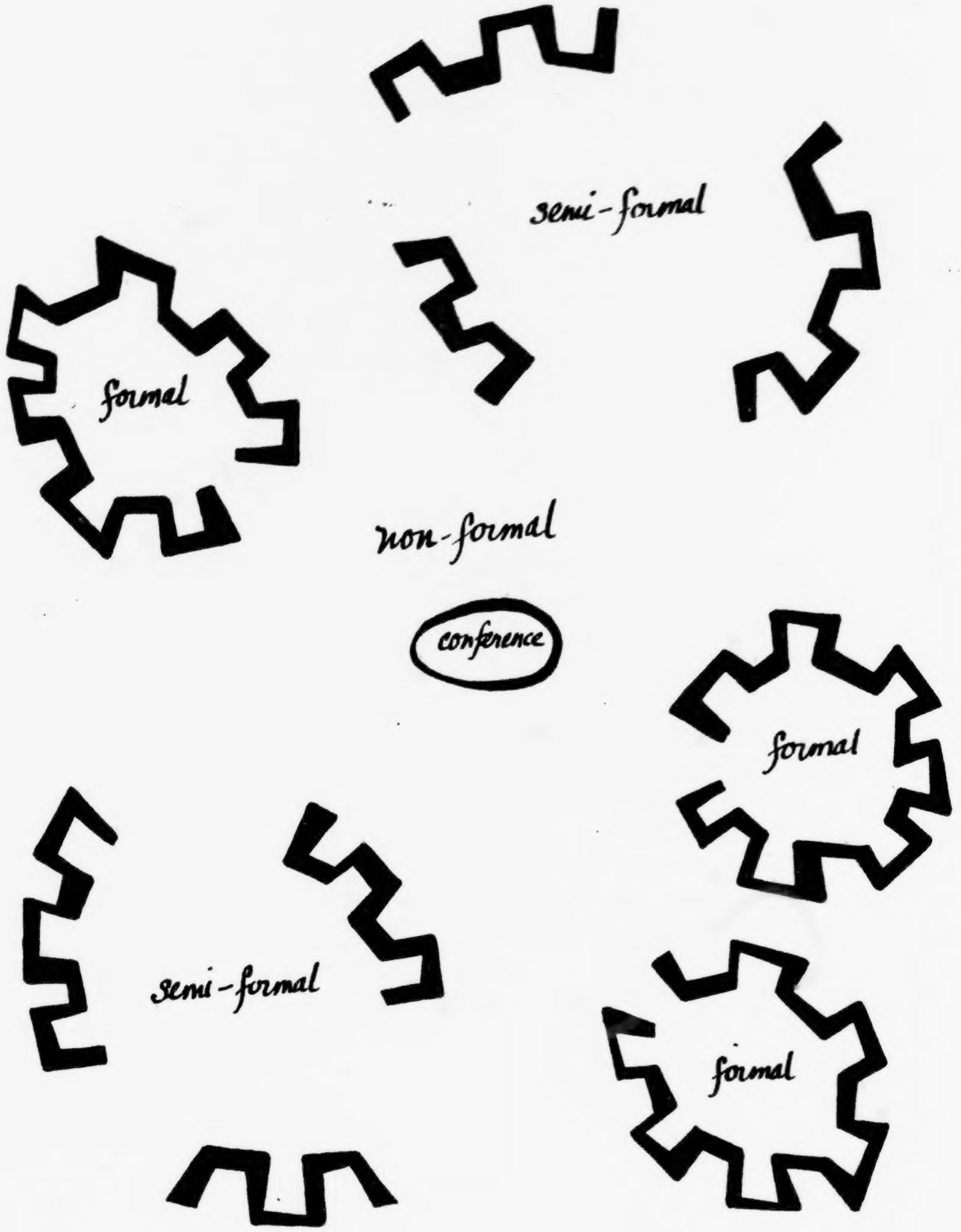
I

the distractions themselves could be controlled by means of separate acoustical cubicles in which the children 'attend the activity'. This violates the basic philosophy that personal interaction is the best group learning situation. Third, distractions must be overlooked and passed off as being unimportant relative to the activity. This condition depends largely on the frequency and magnitude of the distractions. Distractions would be a major problem since unrestricted movement implies a high frequency of movement, and the attention spans of many of these children are short; consequently, they will want to move. Because they are blind, their moving creates more distraction than would a sighted person's movements. Therefore, the child's freedom of movement must be somewhat restricted, and distractions caused by students' moving must be minimized. The problem of distractions is one which applies more to formal activities than to semi-formal or non-formal activities; since the structure of formal activities cannot tolerate the flexibility of less formal activities.

Although this conclusion can be considered primarily programmatic, or organizational, it does have physical implications. However, it is not necessary to provide special means of entrance and exit for activities to avoid disturbance. The circulation pattern of students is changed: unrestricted movement through all activities is not permitted. In the diagrammatic form solution, control is represented by openings into activity spaces. The number and size of openings are larger in less formal activities, showing less movement control into these activities.

Another conflict within the solution statements is in allowing the teacher to supervise a group and also to be accessible to individuals. This is solved if children are able to approach the teacher. Integrating the teacher into the activity rather than placing her in a position apart from the group would facilitate student approach. Implied in the statement is private student-teacher conference. Supervision over the group would not be direct if the teacher were to leave to confer or to give individual aid to a student; but group supervision could be adequate if maintained indirectly from a vantage point on the periphery of the main group activity. In the diagram, the small protrusions serve this purpose. They give the blind child a place to go for privacy, individual aid, individual work, tutoring areas, etc. The protrusions opening onto non-formal activities serve the same purpose for formal and semi-formal interiors, and are areas from which observation of children and indirect supervision can take place.

In summary, there are three basic types of activities (see solution statements) available to the child. These activities are connected such that easy movement among them is provided. Individual work, aid, tutoring, assistance areas are immediately available to the child. Teacher(s) is (are) integrated into the group activity. Staff conference area and records storage area are centrally located with regard to teaching activities.


semi-formal
formal
non-formal
conference
formal
semi-formal
formal

REQUIREMENTS:

8. If a blind child cannot get help from the teacher when he needs it, he may disturb people around him by asking them for assistance.

9. When a teacher instructing a group of blind children must devote his attention to a single student, the other students will waste time for lack of direction.

23. Because a child's attention easily dwindles in a prolonged activity, he often becomes restless and seeks diversions.

33. Non-academic movement and talking by blind students hamper a teacher's control of a class.

39. If a blind child feels that he can escape punishment, he may disrupt activities through lack of self-control.

41. When a blind child feels that other children are receiving attention rightfully his, he often becomes demanding or hostile.

59. When a blind child's needs and desires are catered to preferentially, others around him will often become jealous and/or condescending.

63. When working at a level which produces no sense of accomplishment, a child will seek a level where he can succeed.

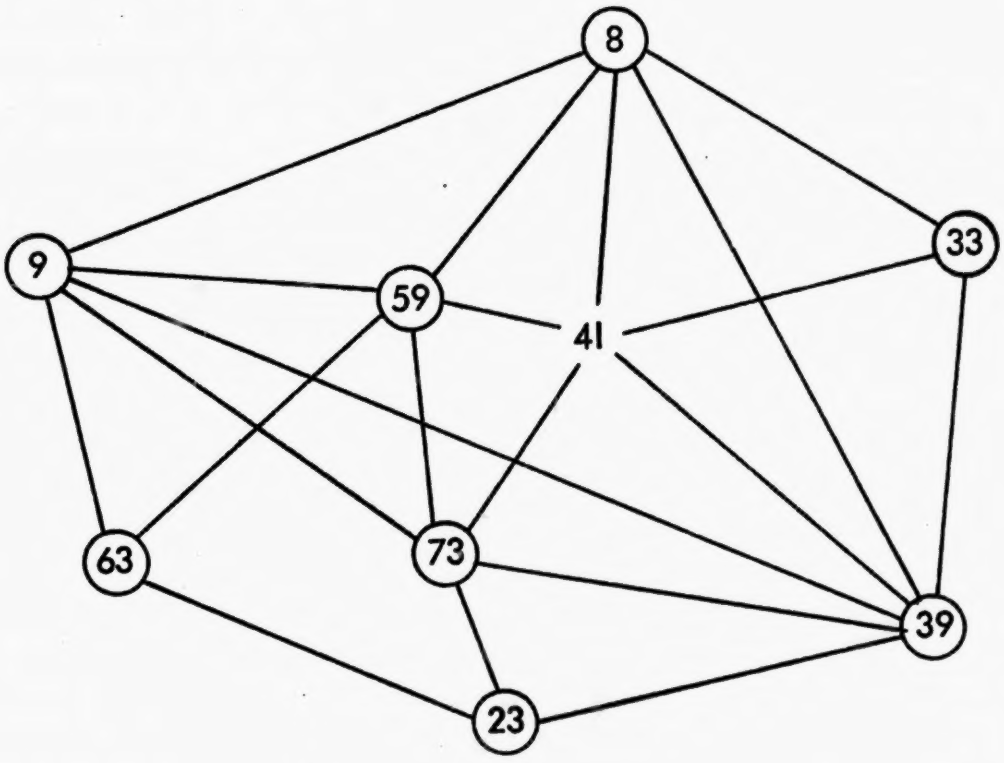
73. If children are not grouped for educational instruction according to level of academic achievement, teachers must adjust content and method of instruction to suit each child's academic abilities.

J

Relational Topic

This subsystem deals with the way a blind child receives help and attention in formal activities, the conflicts resulting from preferential treatment, the way in which a child may obtain help from a specialist, and the process of a child's evaluation by teacher-therapists and specialists.

Lattice

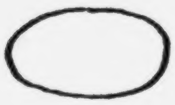


Key interactions and their derived solution statements:

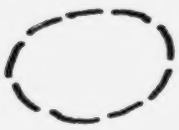
- (8-9) (8-33) (8-39) (9-39) (9-63) (23-39)	Keep the formal activity group size small so that the blind child will feel watched, attended to, and therefore less likely to waste time and make mischief. His progress should be accurately evaluated. Group size should be determined by attention span of the children in it, their ability to tolerate inattention, and the time necessary to both help a child and evaluate his changing needs.
- (8-9) (33-39)	In a formal activity the teacher-therapis must be in close proximity to all the children so that he can quickly change his focus of attention from student to student preventing students from wasting or disturbing others.
- (9-73)	Students with emotional or physical problems, who continually disorganize a formal group activity, must be provided areas isolated from the "normal" group.
- (8-59) (41-59)	A student needing intensive care must receive it in isolation from his peers, not needing such care, as they will become jealous or condescending and distract others if they think he is receiving preferential treatment. The destination of a student receiving specialized treatment should not be evident to this peers.
- (9-39) (9-59)	At lower perceptual levels there is an intense concentration of educational effort upon a few students at any one time by any one teacher-therapists. The assumed scarcity of teachers will require a larger group of students in informal activities from which are drawn smaller student groups for intensive help.
- (33-39)	Since the teacher-therapist cannot leave a formal activity unattended, provide supervision for children who must leave the group while it is in progress.
- (8-33) (8-41)	The noise, interest and movement of blind children not engaged in a formal activity will disrupt that activity, and therefore they must be isolated from the activity. The less perceptually developed "outsiders" will require supervision, while the more perceptually developed will not.
- (9-73)	Specialists must be located closer to the less perceptually developed blind children than to the more perceptually developed blind children because a specialist will work with those children more frequently and in smaller groups.
- (9-63) (23-39)	Formal and informal activity areas provide the blind child many varied potential interests and through his relative degree of involvement in them, his interests and development are better known.

- (9-63) (41-73)	So that those planning a blind child's program can know about the child's total interests and development, and the resources and available to help him, reports must be filed by and available to the various individuals dealing with the child.
- (9-63) (59-63)	Provide more than one judgement of a child's progress and interests, so that his educational placement will be based on a comprehensive and less personally biased evaluation.
- (9-63)	Provide informal meeting areas so that those most concerned with a blind child's development can meet at least once a day to discuss their students.
- (59-63)	Since a blind child's records must be continually updated and condensed, this is best done by the individual most involved with the child.
- (9-63)	Provide formal and casual meeting areas for the staff so that they can exchange ideas about a child's developmental problems and discuss new approaches.

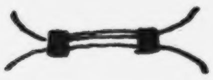
Discussion: The diagrams for this subsystem indicate only those physical form relationships called for by the interacted requirements of the subsystem. Because many relationships can vary within certain limits and still be a form solution to the subsystem, every attempt has been made to specify these limits. Diagrammatic symbols have been developed to accurately indicate these relationships and their limits. The following symbols are used in the diagrams dealing with the structure of the formal activity areas for the various levels of perceptual development.



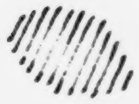
Bounded area with some determinant boundary characteractics.



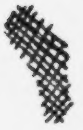
Area with undefined boundaries.



Sealable access point between two areas. Location on the boundary is indeterminant.



Area supervised when in use.

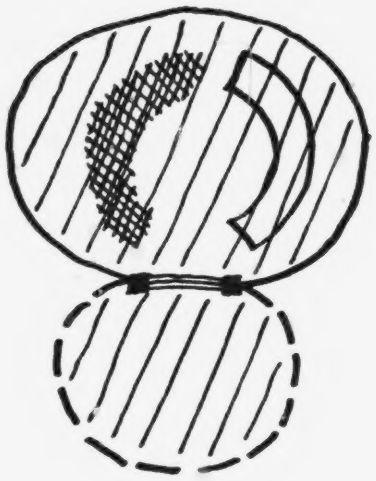


Blind child work area.

J

Discussion:

Lower Level Area: (Characterized by blind children who are so perceptually undeveloped as to be unable to find their way about in a formal activity area.)



Area Boundary: Area boundary provides isolation from outsiders and noise.

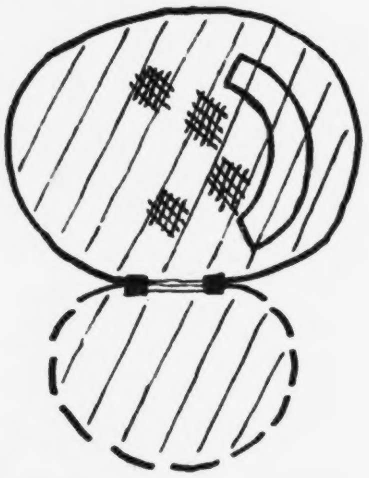
Point of Access: Although an access point is required, its location is indeterminant. Access of outsiders is supervised by someone external to the activity area. The access point must be sealable by a teacher-therapist using the formal activity area.

Group Size: It is undetermined, but small. Variables control the size of the group attention span and time necessary to work with a child at each contact. The child must not become restless between rounds of attention. The period of contact with a child must be long enough to allow the teacher-therapist to guage the child's rate of development and changing needs.

Position of Blind Child in Formal Activity Area: Whether or not he should be assigned a permanent position or be able to touch other blind children in that position is indeterminant. He must have a large variety of interesting objects available to him, and at this stage of development these should be provided by the teacher-therapist. These objects must be easy to take to the child. No child must be permanently more distant from the teacher-therapist than others. The form relationship internal to area boundary is a semi-circle of student work areas and a semi-circle of object storage with the teacher-therapist moving between the two.

Supervision Beyond Formal Area: When the child must leave group activity in a formal area the teacher-therapist must not have to accompany him. This problem is solved by supervising the area necessarily accessible to a blind child beyond the formal activity area.

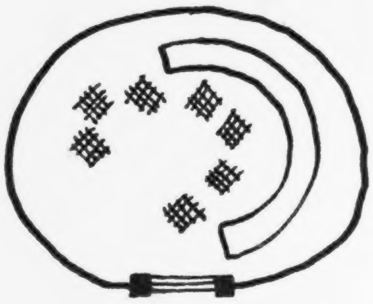
Intermediate Level Area: (Characterized by blind children who can find their way about in small areas. The lower and intermediate level formal activity areas are interchangeable in the larger scale form relationships to follow.) All the relationships described in the lower level activity area are maintained except for the following changes:



Position of Blind Child in Formal Activity Area: The semi-circle of storage of objects is now behind the semi-circle of students. The teacher-therapist operates from the center of the semi-circle of students, as at the lowest level, but must be able to pass between the students to the storage area whenever necessary. For this reason the student areas are separated.

Upper Level Formal Activity Area: (Blind children using this area have very few if any navigational problems and are perceputually developed enough to engage in formal academics.) All relationships described in the lower level activity area are maintained except for the following changes:

Group Size: The same criteria apply as listed in the lower level of perceptual development. However, since a child can work alone for longer periods and can readily communicate his desires, larger groups can be successfully handled.



Point of Access: The point of access to the formal activity area need not be externally supervised, since blind children at this level are not prone to mistakenly entering the wrong class-room.

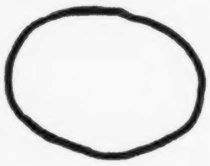
Position of Blind Child in Formal Activity Area: Since teacher-therapist will not have to move so frequently from one to another, the blind children can be further apart.

Supervision beyond Formal Area: Supervision beyond the formal areas is not necessary.

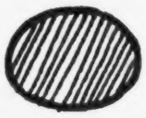
J

Discussion:

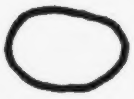
The following symbols in addition to those presented earlier are used in the development of the final form solution diagram.



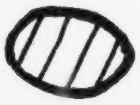
Bounded Area: Boundary configuration unspecified. Enclosures resulting between bounded areas have no significant meaning. Tangency of bounded areas without an access has no significant meaning. Relative sizes are only suggestive.



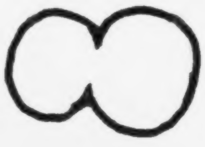
Area available only to staff. The number and ratio of all area types are only suggestive.



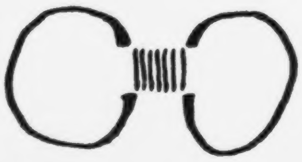
Area available to blind child and staff.



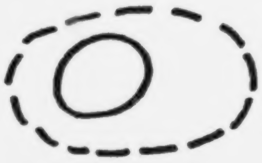
Area supervised when blind child is present.



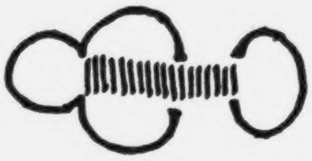
Areas immediately accessible to each other. The relative position of two or more accessible areas is indeterminant.



Close access required, but need not be immediate. Relative distance separation has no significant meaning. This symbol must not necessarily read as a hallway. The number and separateness of access points is indeterminant.



One area included within another.



Close access required between two areas with mutual access through third area.

⟷ Distance separation required.

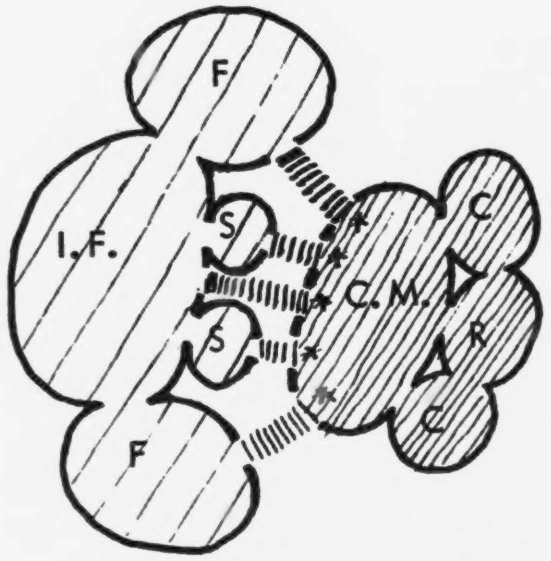
In the diagrams, only those relationships required are indicated. Upon combination, additional relationships are possible, as long as they do not destroy those indicated or conflict with the specified use characteristics of the part or whole of the form.

Lower Level Blind Child's Areas:

Relationship between formal and informal activity areas: This relationship is based on the need for very small numbers of blind children to be worked with intensively for relatively short periods of time, and the assumption that there will be a smaller number of teacher-therapists than there are children. Other blind children receive less intense, supervised play-help. If child is a trouble-maker in formal activities, or needs specialized ehlp, he can be placed into the informal activity area which is supervised.

Informal activity area and specialists: Should the child prove to be too unmanageable, obviously needing immediate specialized attention, he can be placed with a specialist. The specialist must be immediately adjacent. Supervisor teacher-therapists in the informal activity area will not have to leave their area. By keeping track of the blind children in their areas the teacher-therapists keep them from disrupting the formal activity areas. If the child has a scheduled session with a specialist, the supervisor teacher-therapist will not have to leave the informal activity area to assure the child's arrival at the specialists.

Casual meeting area and formal, informal and specialists areas: The dasual meeting area must draw teacher-therapists, specialists, and observers together at frequent intervals for informal discussion of daily progress of the children. To draw the staff, the area must offer more than the possibility for conversation, thus suggesting a staff snack and lounge area. Stored adjacent to this area are the records of each childs's development to be used for review, either in the informal area or in the conference area. Since the conference area will be used for more formal review--possibly weekly--of the child's development, it must be immediately accessible to the record storage area. The records will contain teacher-therapists evaluations, specialist's evaluations, and observations on how the child performs in his free-time activities. The individual having the greatest contact with each blind child and who also has adequate training to understand how to deal with problems of the multiply-handicapped, will be responsible for keeping that child's evaluation current.



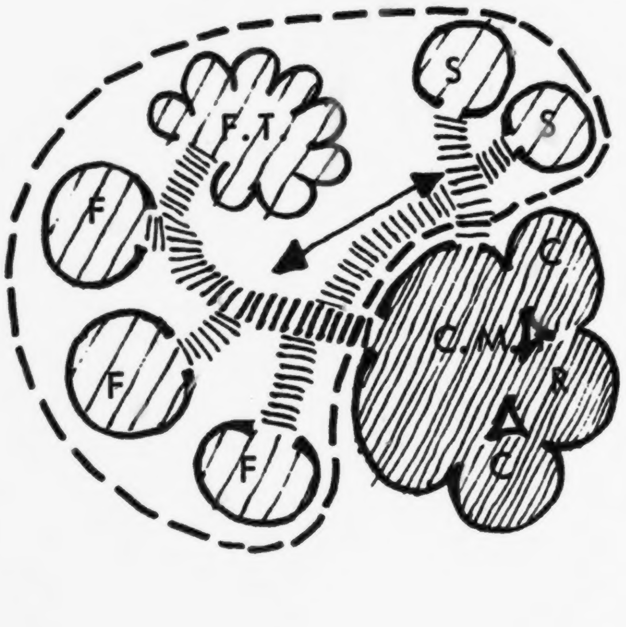
F = Formal Activity Area
S = Specialist Area
C = Conference-Instruction
R = Records
I. F. = Informal Activity Area
C.M. = Casual Meeting Area for Teacher-therapists and Specialists.
* = All access points so marked could be combined into one or more access points to the area in which the asteric occurs, if desired.

Upper Level Blind Child's Areas:

The child who is troublesome, to the point of making a group inoperative, works either with a troublesome group in a formal activity area, or if he must receive special aid, he works in the specialist area. At this level it is assumed that the child will also see a specialist at scheduled times. Knowledge of a child's visits to a specialist must be kept from his peer group. This is achieved by having the child leave to begin a session with a specialist just after a class has ended and by having him take a route to the specialist area which allows him to leave his peers before it is evident to them that he is going to see a specialist. The characteristics of this route are defined within the boundary of Area #1. This area includes other as yet unspecified areas arranged so that when approached in route to the specialists they are plausable and unstigmatized destinations for the blind child. Since the specific nature of most of these other areas is not defined in this subsystem, the specifications for Area #1 become a general modifying relationship which must be applied upon combination with other subsystems. The specialist area is somewhat distant from the formal activity areas. In route to a specialist, a child should pass by, but not through, the free-time areas. Passing through it would be too much of a potential distraction.

The free-time area consists of as many different activities as possible which might interest a blind child who is in the higher level of perceptual development. These various activities must be arranged so that a blind child can become familiar with the existance of all these activities, and then pick the one which interests him most. It must be easy for him to change activities and to continually be made aware of the existance of other activities. Thus when possible, all free-time activities should occur in the same area, if not, they must be immediately adjacent to each other.

The intent of free-time areas is to accelerate development by allowing the child to match the activity to his developing aptitudes and skills. Each change in activity interest should be put into the child's records, and hopefully discussed with the group concerned with the child's program. Because of the potential for unwanted distraction, the child must not pass through free-time areas when changing formal activities.



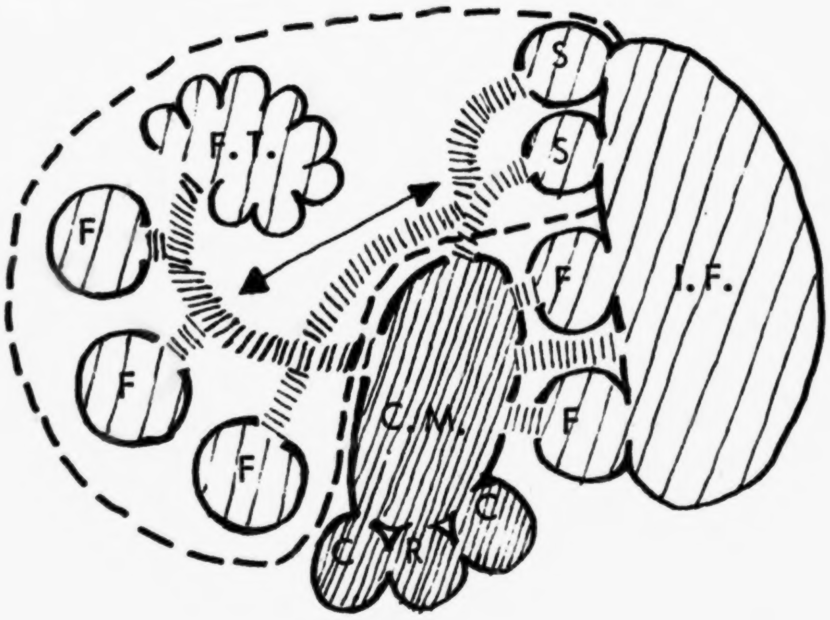
F = Formal Activity Area
S = Specialists Area
C = Conference-Instruction
R = Records
C.M. = Casual Meeting Area
F.T. = Free-time Area
— — — =Boundary of Area #1

Final Form Solution:

There are only two changes that occured as a result of the combinations:

1. The specialists are shared by the upper and lower areas. This sharing of specialist (and specialist areas) is based on the prediction of a scarcity of specialists. This sharing does not significantly change the form relationships of either the upper or lower area.

2. The casual meeting area is reasonable close to both the specialists and the formal areas of both upper and lower divisions. The sharing of this area is done to encourage a greater exchange of information among all individuals concerned with the blind child's development.



J

REQUIREMENTS:

23. Because a child's attention easily dwindles in a prolonged activity, he often becomes restless and seeks diversions.

27. If other children are outside immediate reach, a blind child has difficulty establishing and maintaining communication and social interaction.

32. When they must compete with sighted children in visually-oriented activities, blind children feel inferior and frustrated.

36. When physical involvement does not accompany a verbal description of a physical organization or process, a blind child's conceptual image of the process or organization is often distorted or incomplete.

48. The anti-social attitude of most emotionally-disturbed blind children will cause them to withdraw from any form of group participation.

65. When a teacher-therapist must devote time merely to keeping track of students, his instruction will be sporadic.

66. If a child's communication with people is limited to a fixed group, his motivation and social development will be retarded.

73. If children are not grouped for educational instruction according to level of academic achievement, teachers must adjust content and method of instruction to suit each child's academic abilities.

83. If a child is isolated from his peers, he may become aggressive or introverted, hindering his participation in groups.

85. When a child's activities are limited to group participation, his individual initiative is often repressed.

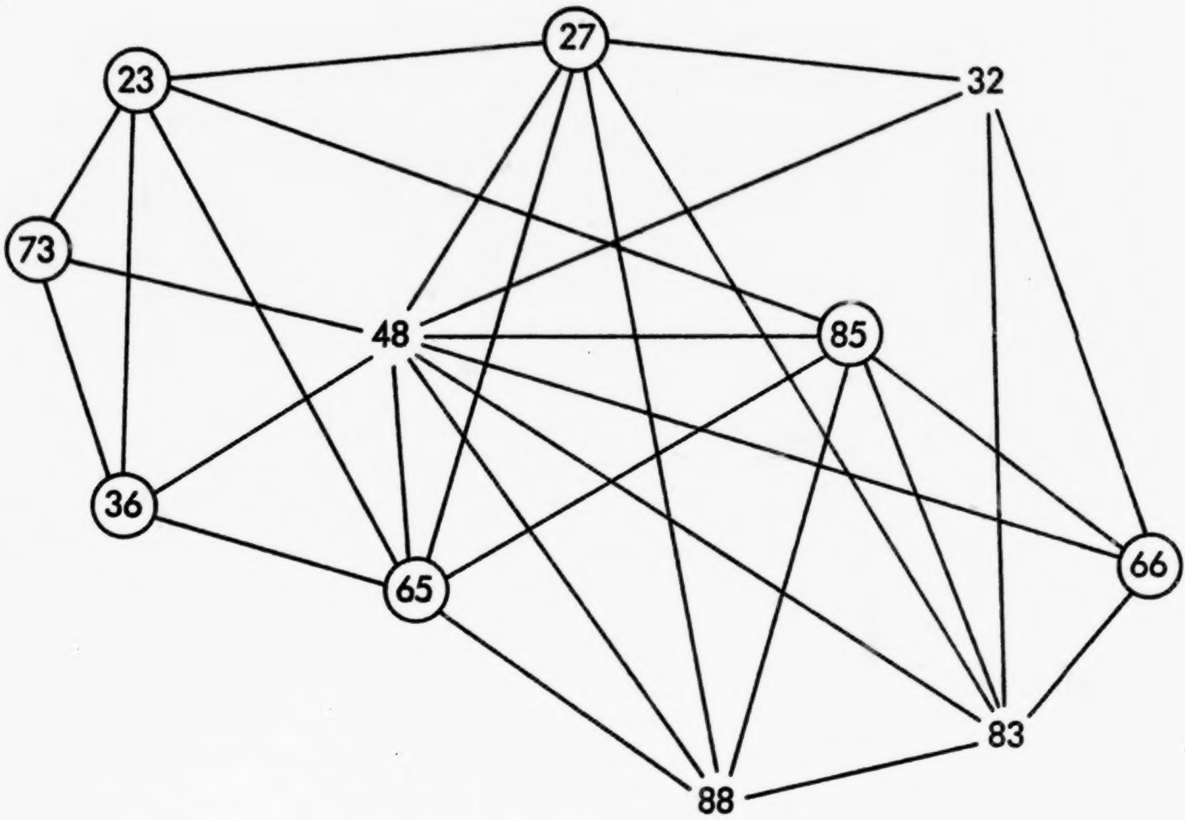
88. Because a blind child in a group activity has difficulty identifying himself as a member of the group, his participation is often sporadic.

Relational Topic

K

This subsystem deals with how the blind child participates in activities and the relationships involved between peer groups. It also investigates the need for diversions from activities and control over the access to them.

Lattice



Discussion

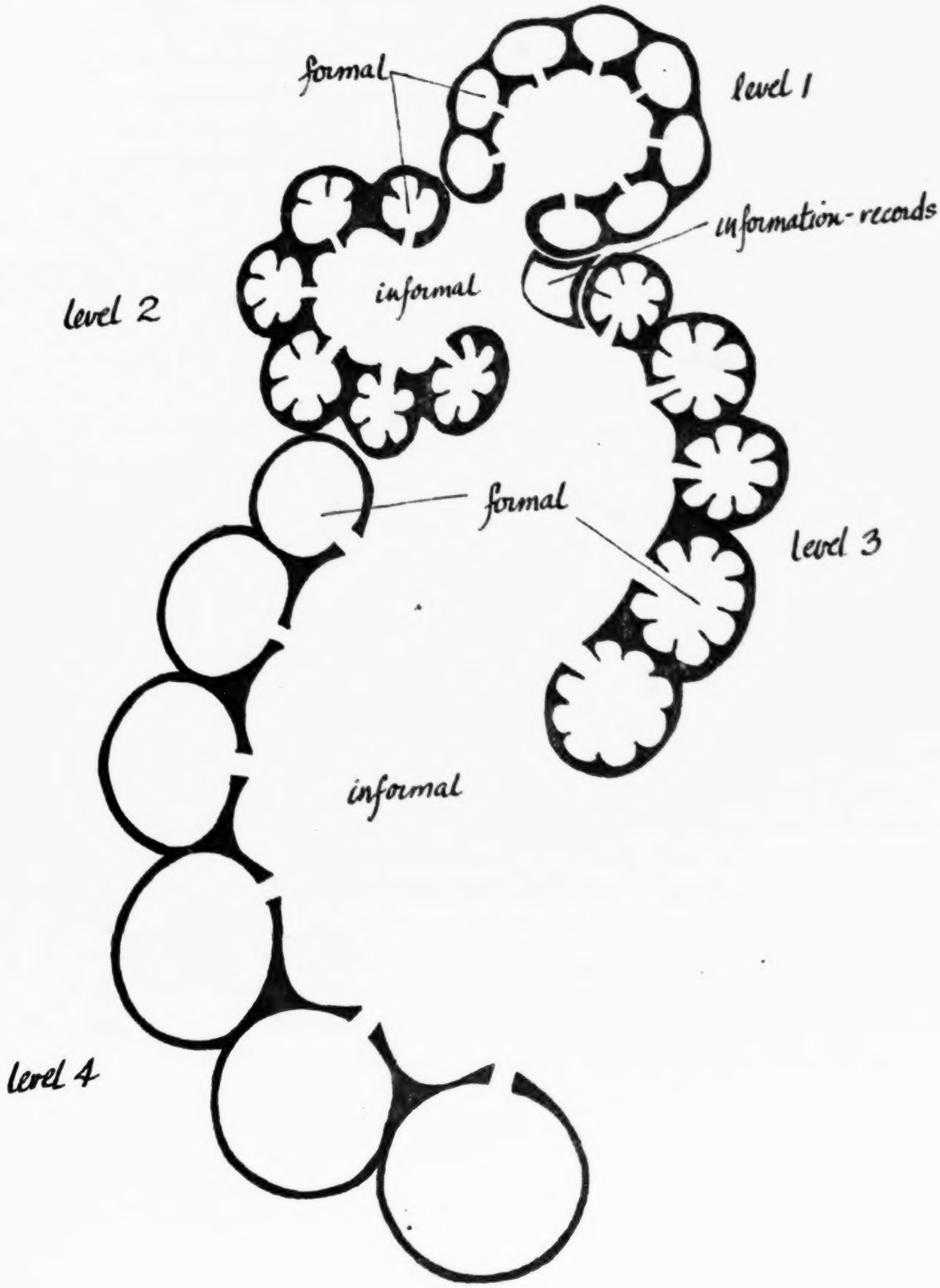
The primary form implications of the requirement interactions of this subsystem are: the emotionally disturbed should be kept close enough to others so he cannot withdraw from a group (27-48); there should be a compromise between group and individual activities (48-85); contact between peers should be allowed and encouraged (48-83); child should be able to identify himself in a group -- space and location should be such that identity is reinforced (48-65-88); the child should not be limited to activities with his peers alone -- he should be allowed and encouraged to work individually (83-85); content and conduct of instruction should be able to change directions easily to accommodate the child's short attention span (23- ; children should be grouped according to physical and mental capabilities because of the need for verbal and physical coordination in instruction (36-73); teaching areas should be easily understood by the children -- as complex in size, shape, etc., as the childrens' level of comprehension (36-65); diversions from formal activities should not be easily available to the children -- the supervisor should assume control of the diversions (23-65); children should be located so they do not talk to one another in a formal group activity unless it is in the interest of the activity (23-27).

Additional form implications from highly-interacting groups of requirements are: From (32-48-66-83): The blind child should participate in varying group activities (with peers, not with peers, with blind, with sighted, etc). The blind child should have alternating group and individual activities. The sighted and the blind should be mixed, but not in competition in visually oriented activities. From (27-32-48-83): The blind child should have close physical and audial contact with others for group activities to occur. Blind and sighted children should be mixed only in those activities in which the blind can compete. From (23-36-48-73): Activity areas should allow for changes in activity. Activity area should be able to accommodate simultaneous verbal and physical activities. From (23-36-48-65-73): Academic groups should be children of similar mental and physical capabilities. Class space should be free of present diversions, but diversions should be readily and easily available, with access controlled by the supervisor (teacher/therapist/helper). From (27-32-48-66-83): The child should have contact with several types of groups and children, but he should only be in competition with his peers (most critical for the least developed children). If the blind are to compete with the sighted, they should be able to talk to and touch each other; there should be close proximity between sighted and blind when in the same group. From (27-48-65-83-66-88): Spaces should allow for easy transition between group and individual activities. Group activities should generally consist of peers. Location and placement of students should aid their sense of identity and also minimize communication which is unrelated to the activity. From these form implications, the following assumptions and solution statements concerning the child's development were derived:

1. The distance a blind child travels between activities is less critical as his mobility and ability to comprehend organization of physical form improve.
2. The complexity of a blind child's environment should not require a perceptual involvement beyond his ability to stay involved.
3. As development increases, formal activities should become more specialized, i.e., definite courses of study should be established.

4. The necessity for scheduling classes increases with the increased specialization of formal activities.
5. The more specialized the formal areas, the greater will be student movement between formal areas.
6. A blind child should have a range of activities within his capability level.
7. A child will require less supervision in the non-formal areas as his level of development increases.
8. The more formal the activity, the greater should be the control over the movement to/from the activity by the children.
9. As the level of development increases, children are more able to play with a wider range of types of children.
10. As the level of development increases, a blind child relies less on teacher guidance per unit of individual work.
11. A blind child will have a greater desire to participate in any group work if he is with his peers.
12. The critical distance which prohibits communication between blind children increases as their perceptual abilities improve.
13. As the level of development increases, the blind child's attention span increases so that he requires fewer changes in activities to keep him busy.
14. The formal activity area should be so constructed that the blind children are partially constrained into continual participation.
15. As the level of development increases, the blind child relies less on tactile communication from the teacher or other students in doing their work.
16. Movement barriers must be more perceptually obvious and unavoidable for the less perceptually developed.
17. As the level of development increases, a blind child can work with larger groups.
18. Blind children should be grouped for formal activities by similar academic abilities.
19. The more developed children are able to mix with the sighted more than the less developed because they have adjusted, at least partially, to their handicaps and they have established a base of experience similar to the sighted.
20. As the level of development increases, there is less necessity for immediate access to therapy areas.
21. Information/records regarding the blind children should be centrally located so there will be no confusion or hesitation when desiring information.
22. It is important that the blind children have rapid and easy transition between formal as well as informal activities.

Form Solution: The form solution is basically a series of formal or class group areas, grouped into a progression of four developmental levels with a distinct perceptual division between them. The upper grouping, for the least perceptually developed, has a high degree of supervision in the common informal area and in the unspecialized formal areas. As the levels increase developmentally, the common informal areas become more open and less supervised and the formal areas become more specialized through the introduction of adjoining subsidiary areas. At the most developed level, each formal area becomes a specialized activity and the informal area extends into the environment of sighted peer groups. An information-record source is centrally located.


formal
level 1
information-records
informal
level 2
formal
level 3
informal
level 4

K

REQUIREMENTS:

6. Because a blind child must concentrate, mentally and physically, in order to cope with his immediate environment, he is often fatigued by physical tasks.

12. When a blind child's practice in mobility and orientation is restricted to a known environment, he becomes confused and insecure in a new or changing environment.

23. Because a child's attention easily dwindles in a prolonged activity, he often becomes restless and seeks diversions.

35. Because he cannot visually observe the physical actions of others, each blind child must experience these activities in order to understand them.

44. If a blind child with undeveloped muscular coordination is denied constructive opportunities for physical exercise, he will not learn to restrain his uncontrolled movement.

51. If a blind child is compelled to learn or react at a rate not suited to his abilities, he will become inattentive or resistive.

57. Because a hyperactive child releases his energy vigorously, limiting his actions will frustrate him.

81. Because a blind child's study equipment and materials are bulky and unwieldy, he may be discouraged from using them.

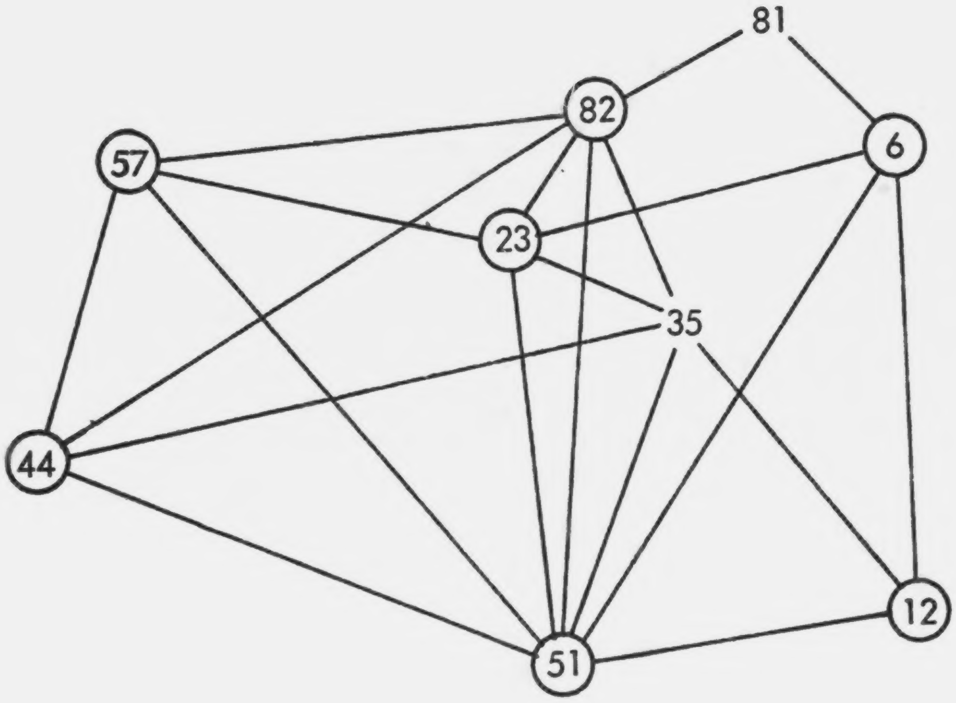
82. Without outlets for physical energy, children will willfully damage or destroy objects in order to vent their frustrations.

L

Relational Topic

This subsystem deals with the problems of the blind child in activities and how he can be assisted by location within and control of the environment.

Lattice


81
82
6
57
23
35
44
12
51

Discussion

Some form implications of individual requirement interactions are: a child's exposure to new environments should be short in duration (6-12); there should be control of the number and difficulty of tasks the child participates in (6-51); the child must be directly involved in an activity for his attention to be maintained (23-35); a time and place for physical exercise and outlet of pent-up energy should be provided (23-57) and (57-82); immediate environment should not be complex (51-6); the child should not carry or use unwieldy equipment in areas where he has mobility problems (81-6); objects and equipment should be durable in nature to withstand the treatment of the blind children (81-82); activities between which the children must carry equipment/objects should be in close proximity (81-6).

The form implications of those more highly interacting groups of requirements are: From (44-51-57-82): blind children should have a choice of convenient activities; goal-directed (purposeful) physical exercises should be available to the children; hyperactive blind children should have close individual work with a physical therapist; places of physical exercise should be durably constructed; all activity areas of the hyperactive blind children should be simply and safely composed. From (35-44-51-57): personal assistance in experiencing/learning new things should be provided; constant observation and evaluation of the children in their activities should take place; interaction between hyperactive blind and the more normal blind should periodically take place under direct supervision. From (23-51-57-82): activities should be versatile in content such that they can adjust to the childs momentary needs; activities should be short in length and should frequently change locations; activity areas for the hyperactive blind should be as free from extraneous stimuli as possible; there should be close proximity between formal and informal activity areas; child should have some choice of the level of difficulty at which he participates; close supervision and a high ratio of students-to-teachers/therapists should be provided for the hyperactive blind; the activity environment of the hyperactive blind child should be durable and safe. From (6-23-35-51): child should be gradually exposed to new activities with the assistance and guidance of personal supervision; child should be allowed to choose both the rate at which he is introduced to new activities and the specific activities in which he participates; there should be close proximity between formal, informal, and physical exercise activity areas, but not to the extent such that one interrupts the other; children should be directly involved with an activity -- suggesting perhaps one-to-one ratio of children-to-objects. From (6-12-35-51): there should be consistency of the major physical relationships of the child's environment and flexibility of the individual objects -- suggesting changes of student-teacher positions and object locations; child should be exposed to new and changing environments; there should be continual information on how the child is progressing available to all teacher-therapists having contact with him.

From the above form implications are drawn the following primary form relationships, which serve as solutions of this subsystem:

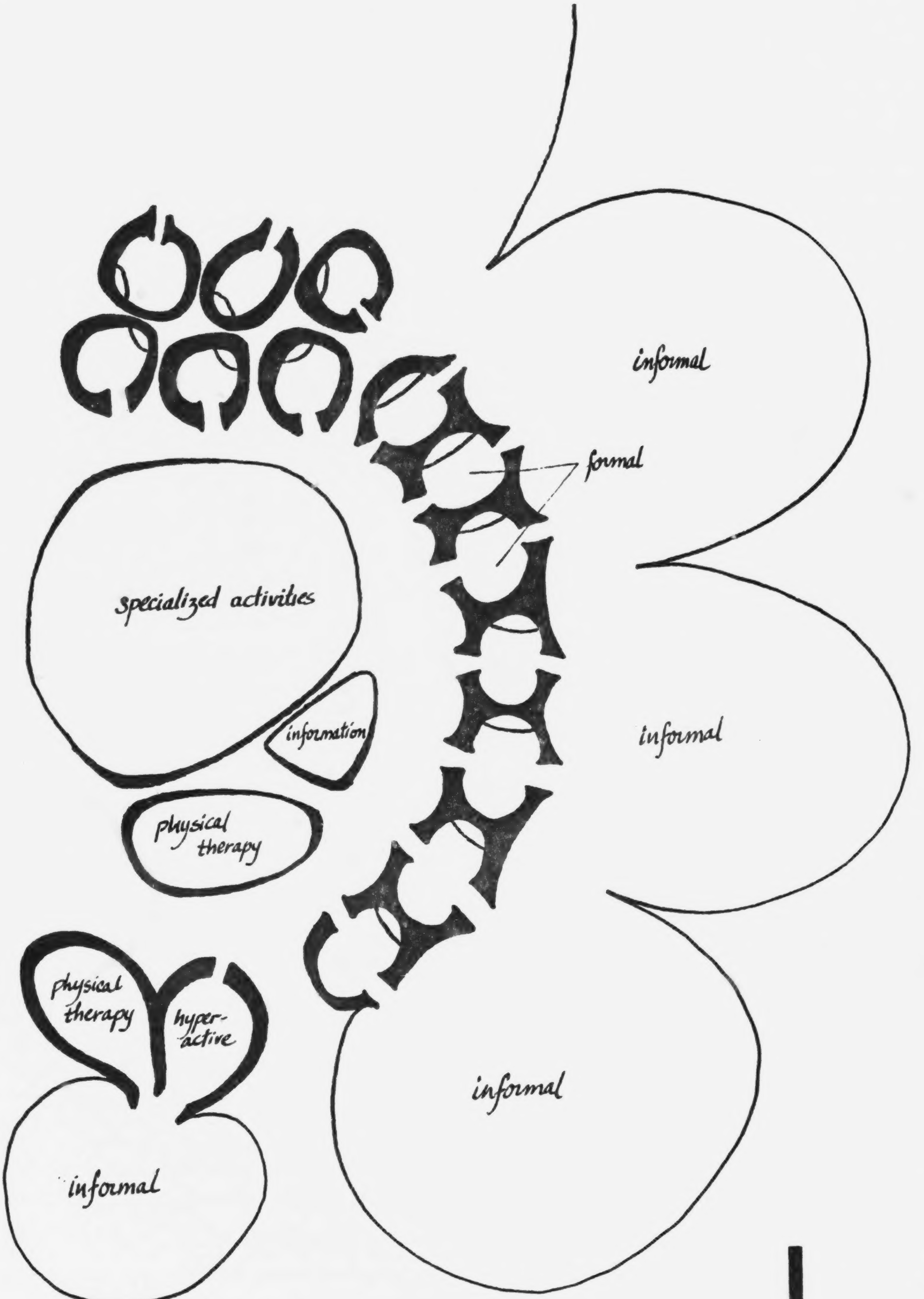
1. There must be direct access between formal and informal areas. This is most important at the lower levels and decreases proportionately with the child's progress in ability to navigate.

2. Activities which cannot take place in the formal areas, i.e., those requiring special equipment which must be shared or must be kept in a fixed location for occasional use, must be immediately accessible to those formal areas; this is also more critical for those less developed.
3. Physical therapy must be in proximity to the lower-level children and be most easily accessible to them.
4. There must be storage areas within every formal activity area for equipment necessary for that activity; some of these storage areas must be accessible to the child while others should not be. The storage area must be in close proximity to informal activity areas for the less-developed children.
5. A centralized information source or location needs to be easily accessible to all lower-level teacher-therapists.
6. Contact with the outside world (community) must increase in quantity as the child becomes more developed.
7. Informal activity areas must progress in amount of control from direct supervision to observational supervision.
8. The lowest-level hyperactive blind child needs a far more contained,controlled environment than their more normal counterparts. This indicates an activity area combining formal, informal, and therapy activities for the hyperactive, in contrast to a combined formal, informal area with access to therapy for the more developed counterparts.

The final solution combines the primary form relationships into a system of informal, formal and more specialized activity areas, with further distinction occuring between hyperactive and non-hyperactive children. Throughout the solution, there is a direct link between formal and informal areas (or class and play areas). This relationship is less clearly defined at the uppermost stages of development (see top clustering of formal areas in diagram), since informal activities are increasingly oriented to the community and children are more able to get to the informal areas. The informal area for less-developed hyperactive children is distinct from the informal areas for the non-hyperactive (see lower left portion of diagram). Its combination with formal and therapy areas create the controlled environment necessary for less developed hyperactive children. From this grouping there is a link through the formal activity area to a centralized physical therapy area, used by all children and most easily accessible to the less developed, whether or not hyperactive.

For the non-hyperactive, there is a series of formal areas (the center of the diagram), each of which contains a storage area. The formal areas are grouped about the more specialized functions of the school. The information source (the smallest of the three areas in the central grouping) is located for easiest accessibility from the hyperactive and lower-level non-hyperactive areas as well as having an implied direct link to physical therapy. Specialized activities, the largest figure in the central grouping, includes all those activities for which specialized equipment or specific environmental conditions will be required.

Degrees of supervision are implied in the diagram through the succession of informal areas, permitting both directly supervised activities when a teacher is involved in the activity and observational supervision, whether done within the informal activity area or from the formal areas. Differentiation between the succession of informal areas implies differing degrees of complexity in the activities occurring and differing demands of physical involvement.


informal
formal
specialized activities
information
informal
physical therapy
physical therapy
hyper-active
informal
informal

L

REQUIREMENTS:

21. A blind child's lack of curiosity to explore his environment will impede his progress in achieving coordination and control over his bodily movements

23. Because a child's attention easily dwindles in a prolonged activity, he often becomes restless and seeks diversions.

29. When a change in activities necessitates a change in location, the time spent moving is often non-productive.

37. Because his environmental stimulation is intermittent, a blind child may seek self-stimulation through physical mannerisms or through withdrawal into fantasy worlds.

44. If a blind child with undeveloped muscular coordination is denied constructive opportunities for physical exercise, he will not learn to restrain his uncontrolled movement.

50. If the handicapped child is not encouraged to develop his limited faculties, their usefulness will deteriorate.

77. Because mentally-retarded children are usually indifferent to their surroundings, it is difficult to actuate them either mentally or physically.

85. When a child's activities are limited to group participation, his individual initiative is often repressed.

89. If the child's "free-time" is completely unstructured or unsupervised, he often lacks the initiative to develop extra-curricular interests.

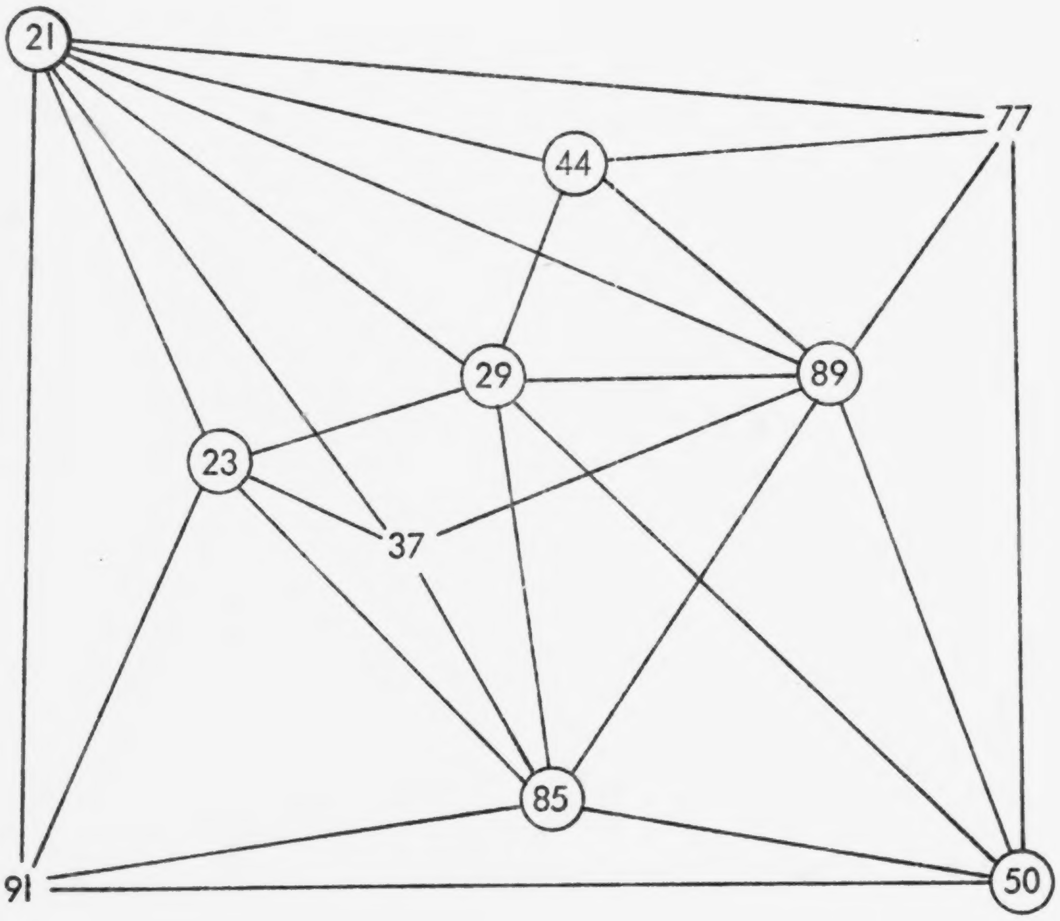
91. When a child's accomplishments in an activity are not apparent, he loses interest in continuing it...

Relational Topic

M

This subsystem deals with the continuum of instruction and free-play, the relationships between formal and informal activity areas, and the transition between activity areas.

Lattice


21
77
44
29
89
23
37
85
91
50

Discussion

The form implications of the interactions and the groups of interacting requirements are:

(50-77-89): The mentally-retarded blind child will need constant supervision for both formal and informal activities at the lowest levels, decreasing as he progresses. Small group activities emphasizing individual work with each child must exist. All stimuli and spatial relationships must be simple and easily understood. Informal activities should offer a wider range of stimuli than formal activities. The mentally-retarded blind child,at lowest levels, will require an intensive-care therapy environment, in an effort to get him functioning in the more normal blind child environment.

(37-85-89): There should be accessibility to and/or presence of teacher/therapists during "free-time" activities. Group activities should have less environmental stimuli than individual activities. There should be a wide range of "free-time" activities, both individual and group, within each blind child level. Teacher/therapists should have, as a minimum, visual and audial access to group activities . There should be audial separation of academic activities from informal activities -- particularly when that informal activity is physical exercise. A child should be able to choose between individual and group activity in "free-time", so long as he is still within a supervisor's audial/visual range.

(50-85-91): Individual therapy and testing facilities should be available both within and outside of a group context. There should be a variety of activities and tasks at all levels in which each blind child can participate according to his personal preference and level of achievement. Teacher/therapists should have easy and quick access to information about any child who might come under their range of supervisional control/responsibility.

(23-85-91): Groups should be of a size such that a child can receive individual attention from the teacher/therapist when needed. There should be easy access by blind children between various levels of academic or non-academic work. There should be a variety of achievable tasks within each blind child's environment. Therapy and testing should take place both by a group and by individuals.

(23-37-85): Clear, strong, simple stimuli are particularly important where the activity demands group participation. There should be both group and individual work for all levels; groups need to be small enough that a single child can get individual attention easily.

(21-23-37): If a child becomes bored with an activity, he should be able to seek out what he would rather do -- proximity of informal to formal activities; formal activities of not too long duration. There should be consistency and repetition of environmental cues for the younger blind child; variety and complexity of cues expands as the child develops. (Finally, the cues must duplicate those of the normal, sighted environment). There should be controled access to group activities, particularly to intensive activities.

(21-23-91): The environment of the blind child should increase in variety and complexity as the child develops. The child should have some choice of activities, whether formal or informal. This conflicts with supervisional implications; the resolution of the two provides variety in the activities available to any child within his own defined environment and allows movement between the activities of different levels; this movement is supervised by the teacher/therapists by letting them have audial and visual access to any child entering the range of their supervisional area. There must be assumed scheduling of activities and barriers between free activity and any activity requiring a child's intensive concentration.

(29-50-85-89): There is a need for a range of tasks and activities within informal activity areas. This also applies to therapy, whether it is structured formally or informally. Non-academic activities should offer practice in differentiating and discriminating between sensory stimuli. Non-academic activities need supervision, but not to the extent that it limits what the blind children do so they become frustrated and lose self confidence. Changes in activity locations should give the child practice in hearing, touching and the tasks of mobility and orientation involved with these senses.

(21-44-77-89): The mentally-retarded blind need clearly useable, simple objects and activities for physical exercise. Physical exercise areas to which children have access should include objects and/or activities interesting to the children, whether or not they have an "educational" purpose -- particularly those objects/activities requiring physical involvement. There should be supervision (not necessarily direct) in all activities: formal, semi-formal and informal.

(21-29-44-89): There is a need for supervision of movement between activity locations, and within an activity area, scaled according to physical level of achievement. Activities should not take place within one location but rather in various locations. Physical exercise should not take place in a single, bounded area, but rather it is a combination of several activity areas; free-time, therapy and general movement within school environment.

The Form Solution:

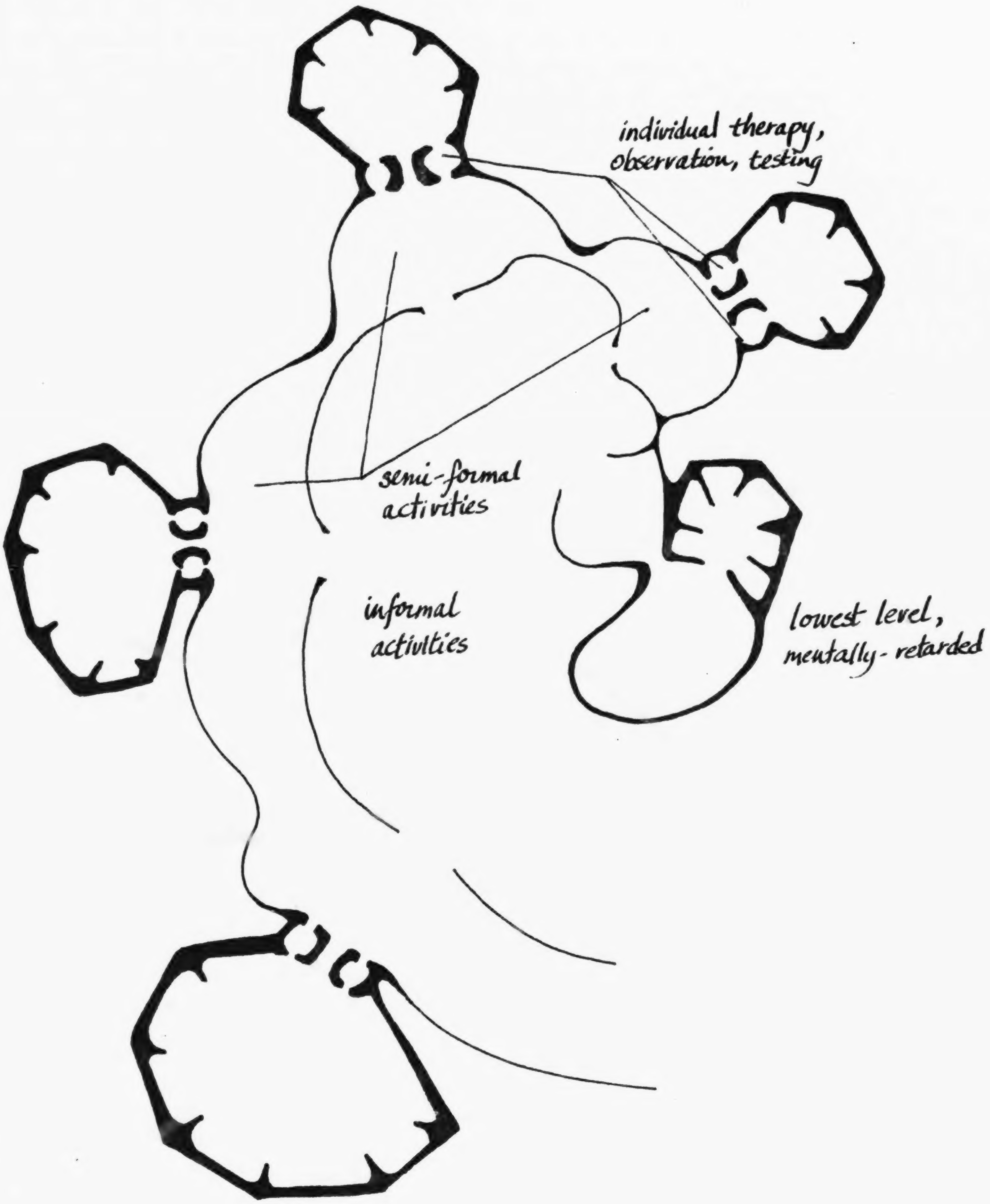
Division of activities: There are three basic activities:formal, semi-formal and informal (in the diagram, in the same order from outer to inner). Formal activities are those which must not be interrupted (requiring teach/therapist control over the activity); semi-formal activities are essentially those formal activities which may be interrupted (the area may function during "free-time" as an individual activity area); informal activities are those least controlled and generating the greatest amount of energy release and noise. Individual therapy, observation and/or testing activities located between formal and semi-formal areas, are accessible to both. Where the child is involved, proximity is necessary to conserve both time and energy expenditure. Where the teacher is involved this area functions as a place for observation of the children within their activities.

Connections of activities: Because a child can be a distracting force when entering an activity, the teacher/therapist must control his physical access to her area of supervision. The resolution of his need for access and her need for control of the students is in permitting access between areas where interruptions may be tolerated without disrupting the activity, thus through the semi-formal or individual free-time informal activity areas. (This is shown in the diagram by physically more separate formal areas). The divisions between activities within the informal activity area depend on the specific activities and their arrangement (there may not be a need for physical boundaries or division, thus the informal area in the diagram remains open).

Supervision of activities: The teacher/therapist needs constant visual access and control of physical access between formal and semi-formal areas under her supervisionary range; this includes individual therapy areas. (This is indicated in the diagram by the narrow openings between areas). The teacher/therapist must be easily accessible and readily available to any child in an informal activity when he needs her. This is more critical for lower-level activities than for upper-levels of development; physical presence is not necessary in the upper-levels, but access is desirable.

Stimulation and recognition patterns: At the lowest levels, stimuli must be clear and strong, since the child must learn to differentiate at a very gross level before he can progress. All ambiguous stimuli must be eliminated from the lowest-level of childrens' hearing, feeling and touching range. The child will be exposed to an increasing amount of stimuli in proportion to his progress of development. The physical relationships between formal and informal activities should remain constant for the lower and intermediate level children in order to reduce the ambiguity of the arrangement, evident in the diagram. At the upper levels, the relationships can become more variable. There should be some aspect of an activity area which is consistent throughout that activity and unique to that activity (for example: same size door-knobs on doors of informal activities which are different from those on doors of formal or semi-formal).

The mentally-retarded blind child: Those who are at a low level or are seriously mentally retarded must be nearly isolated from the more normal children. (See middle right area of diagram). The only point of contact, which must be controlled by a teacher/therapist, would be through informal activities, and in this case, by linking the informal activities of the least physically competent. The area for these children functions as a unit. Formal or academic activities for these children consist of individual areas within the total formal area, each individual area for a specific activity. These individual activity areas are linked by circulation (informal physical activity). This formal area blends into the informal area, containing therapy and physical exercise, and linked by a point enabling easier control by a teacher/therapist.


individual therapy, observation, testing
semi-formal activities
informal activities
lowest level, mentally-retarded

M

REQUIREMENTS:

8. If a blind child cannot get help from the teacher when he needs it, he may disturb people around him by asking them for assistance.

11. If a blind child receives no sound cues from his surroundings he will rely on self-generated noises to establish his position in space.

14. Sounds which are not part of a background noise level will interrupt a student's concentration on his individual study.

16. A blind child's communicating with others often interferes with their individual study.

17. The introduction of sounds irrelevant to an activity will confuse a blind child if he is dependent on the sounds of the activity to guide his participation.

19. When instructions concerning an activity are not received clearly, a blind child's reaction is often non-participation rather than confused participation.

20. Lacking any external cues, a blind child will disorient himself if he cannot measure his movement over time.

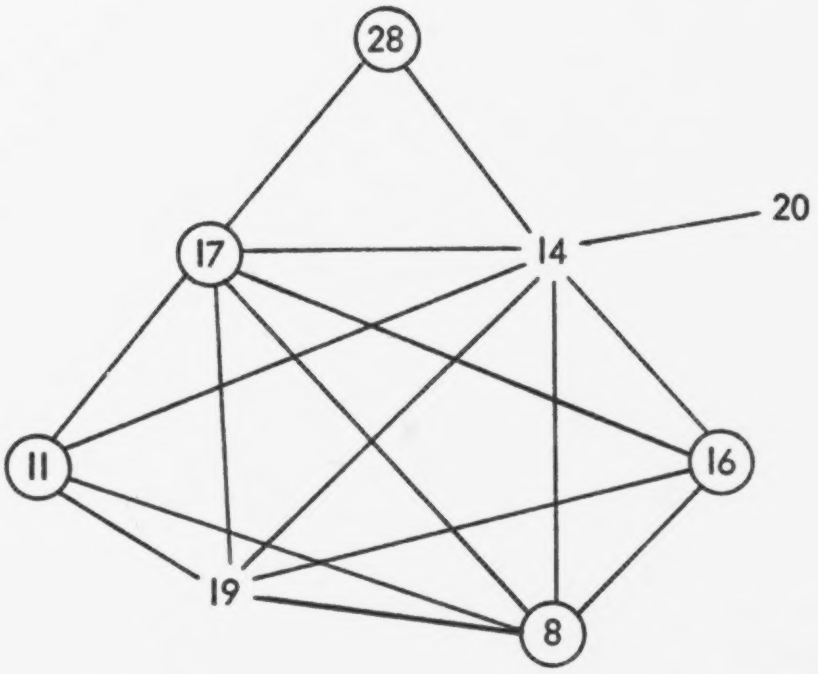
28. Because a blind child cannot visually identify a sound with its source, unfamiliar noises which are loud or harsh tend to frighten him.

N

Relational Topic

Subsystem N deals with sound cues and noise: when they should and should not occur, what sounds should and should not be a part of the blind child's study and activity environment. Loud, harsh and unfamiliar noises, unless used as cues or as teaching devices, should be excluded from the blind child's immediate environment. Individual study requires special provisions such that the sounds of other activities will not become barriers to effective study. There is a need for a communication link between each blind child and a teacher, therapist or helper, such that he can get immediate help without disturbing the activities of others.

Lattice



Discussion

Form implications from requirement interactions are:

-(8, 14) : Teachers should be able to know immediately which student needs help. Teacher and student should be able to meet such that she has control over the class. Students should not be immediately accessible to each other in individual study unless a teacher is instantly accessible to each.

-(8, 16) : Students should be able to get help immediately. Students should be out of auditory contact with each other when in individual study and a teacher is not immediately accessible.

-(8, 17) : Students must have immediate access to the teacher in an activity where talking between students will be disruptive to the activity.

-(11, 17): Extraneous noise should be controlled when the child is trying to establish his location through the use of sound cues.

-(14, 16): Students in individual study should not be able to communicate with each other unless their communication is no more distracting than the background noise level. There should be a separation of those students who are communicating with teachers, helper, etc., from those who are studying individually.

-(14, 19): Noise not a part of the background noise level must be kept from students receiving instructions or engaged in individual study.

-(8, 11) : Those trying to find location should be separated from those who might be disturbed by his asking.

Additional from implications derived from the subsets of requirements which interact are:

-(8, 16, 17) : Where communication is a necessary part of the activity and help is needed frequently, an audial barrier between this activity and those in individual study is necessary.

-(11, 14, 17) : There should be an abundance of sound cues offered to the child so he will not find it necessary to use interruptive self-generated cues.

-(8, 11, 14, 19) : There should be an audial link for giving or receiving assistance (instructions, questions, etc.) such that it is audially discrete from those in individual study.

-(8, 14, 17, 19) : There should be a communication area separate from individual study area. Communication links between student-teacher or student-student should be controlled by the teacher.

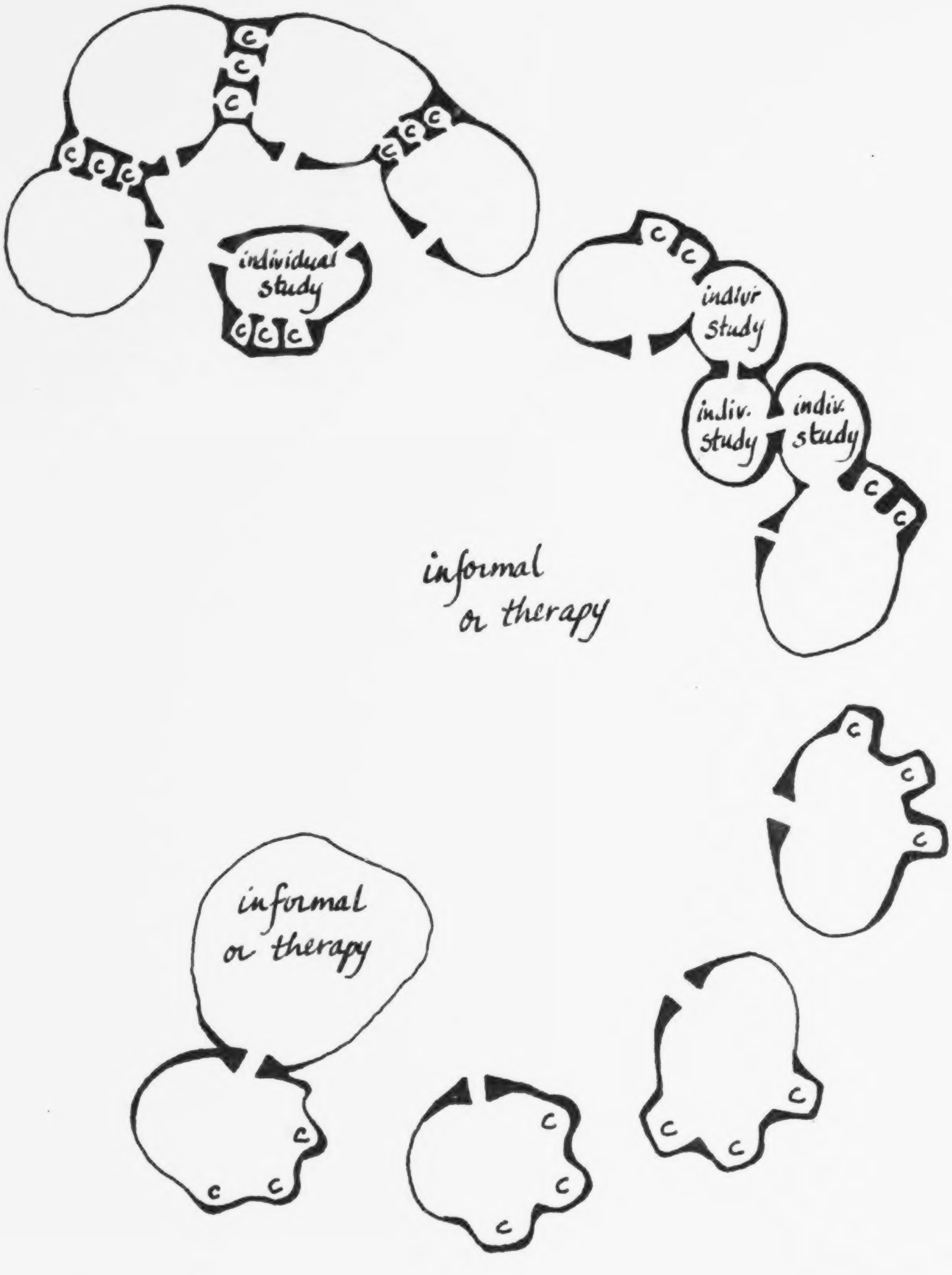
-(14, 16, 17, 19): All communications that exceed the background noise level must be controlled so they will not be a part of individual study.

From these form implications, the following solution statements were derived:

1. There must be a strong sound barrier between activities generating loud noises and activities requiring concentration (such as academic instruction or individual study).

2. Academic areas and the majority of physical exercise areas must be insulated from loud, harsh, or unfamiliar noises. The exception may occur in some forms of advanced mobility and orientation training.
3. Teachers, therapists, helpers, etc. should be able to control access to their activity in terms of noise and circulation.
4. Supervisors must be able to assume control of the academic or physical activities either by physical or audial presence. The combination of the two will be most important at the levels where children are young or immature and will gradually decrease as the children gain competence in their activities.
5. There must be a very high student-teacher ratio at the lowest levels of competence, due to the needs for supervision, control and immediate help (so that a child's need for assistance will not interrupt the action of an activity).
6. Teachers must be able to confer with each other or with a supervisor or helper during other academic activities. At the lowest levels the teacher's ease of access to the students is most important; at the upper levels the student's access to the teacher or others with whom they are conferring takes precedence.

Form Solution: The form solution indicates the variety of configurations that the formal areas take in a child's progression through the school. At the lowest levels (the lower left of the diagram) formal and informal areas are tightly linked, in order to retain control over movement and sufficiently isolate them from outside distracting noises. The formal areas at this level and in the next few stages is a loosely defined area with conference areas on the perimeter for the use by the children either alone or with a teacher-therapist. These conference areas become more distinct from the formal instruction area as there is more need for individual conferences and locations for individual work. The next level indicates a further change, with a separate area for individual study. There is an additional area for individual study within this grouping, for those children who are able to work on their own without direct supervision. The final level contains a series of formal areas with conference areas adjacent. In the center of this upper level is a specialized individual study area, again with its own conference areas.


individual study
indiv study
indiv. study
indiv. study
informal or therapy
informal or therapy
c

c- consultation areas

N

REQUIREMENTS:

2. Parents who don't know how their child is developing in school will often retard this development with inconsistent training.

60. If teacher-therapists do not know how a child is applying what has been taught, they have not way to assess his progress or potential.

67. If an administrator is not familiar with the functioning of an educational program, he cannot evaluate its effectiveness.

68. If teachers and therapists are not familiar with a blind child's additional handicaps, they may aggravate those handicaps through incorrect training.

69. If parents do not understand the procedure for their child's diagnosis, they may neither accept the diagnosis nor support the prescribed therapy.

78. If those responsible for a child's education do not know about innovative techniques or lack the opportunity to apply them, a handicapped child may receive inadequate care.

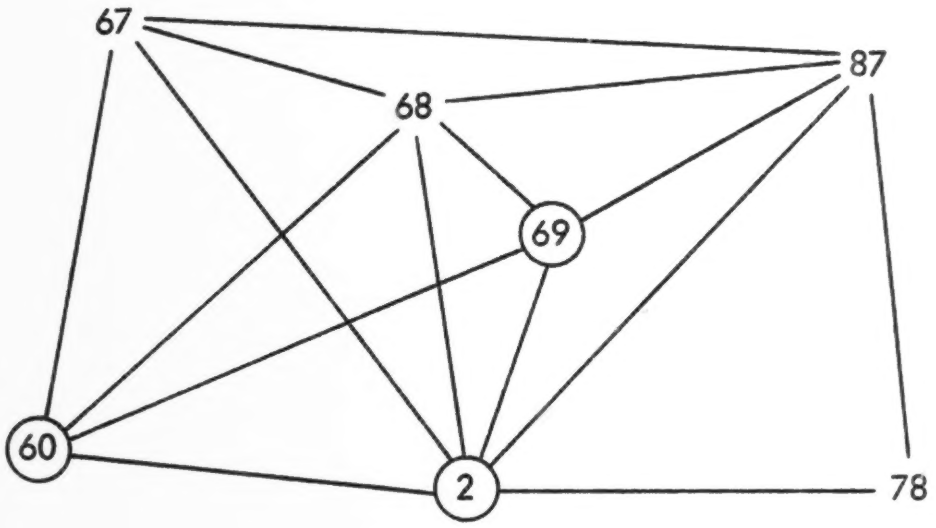
87. If the evaluation of an educational program is done exclusively by those directly participating in its development and application, their limited perspective may retard advantageous revision.

O

Relational Topic

Subsystem O deals with how parents, administrator, and teacher/therapists contact one another to become informed about the blind child's problems and development and the programs and techniques being used to educate him.

Lattice



Discussion

The primary form implications of the requirement interactions are:

- -interactions with Requirement #2: close proximity and communication between all of those having direct care of the blind child with regard to teaching techniques, child progress and difficulties.
- -interactions with Requirement #60: role of the teacher/therapist should vary from participation in to observation of the child's daily activities, and available consultation between administrators and parents.
- -interactions with Requirement #67: free access to instructional work and staff by the parents such that they develop an active role in the educational program.
- -interactions with Requirement #69: parental involvement in the program is encouraged -- in consultation, advising and continual feedback of information between parents and school.
- -interactions with Requirement #78: access to recent innovations and studies available to both parents and staff -- suggesting perhaps a library-type of organization.
- -interactions with Requirement #87: periodic observation of children by diagnosticians not on the staff to insure a varied perspective of the program. Also close communication between those directly involved with the child.

Other form implications from highly-interacting groups of requirements are: the administrator should have access to all procedures within the program and be able to observe (but not directly participate in) the activities and techniques (2-60-67-68); parents should be allowed direct observation of their children operating under the techniques of the program (2-60-67-68); teacher-therapists should be able to observe the children from a removed (non-participation) position (2-60-67-68); teacher/therapists should have access to current and follow-up studies and evaluations of their procedures (2-60-67-68); administrators should be well informed about case studies and about the progress of the students and should advise both parents and staff on educational techniques (2-60-67-68); there should be a very personal exchange of information between parents and teacher/therapists concerning the child's handicaps and development (2-60-68-69); teacher/therapists must be made aware of follow-up results of their work by consultation with other staff members, administration and parents (2-67-68-69-78-87).

From these form implications are drawn the necessary form relationships: in this case, they are based on what activities consist of and the relationship between activities. The composition of these activities and their relationships with other activities are discussed below as they apply to the participants.

Parents: Since parents are very often separated from the school, they can be most easily brought into the system by means of the administration, with whom they should initially have an orientation discussion. On repeated visits, the administration is used as a checkpoint and would facilitate appointment confirmations with teachers or other administrative procedures. It is in consultation that the parent should be shown information or reports on his child and on the school programs. When required, teacher/therapists should join the consultation between parents and administrators.

After contact with the administrator, the parent should have the opportunity to observe the classroom situation or therapeutic treatment involving his child. The parent should observe the activities long enough to understand the entire process which he is observing; partial or incremental observation will not suffice. The parent must be close enough to the activities to understand what is happening and how his child is reacting to the activity, so that he can make some evaluations of the procedure with respect to his child.

Immediately following the observation of the activities, parent-teacher/therapist consultations should take place in an area audially separate from the child. The space for consultation should not be a classroom if it is subject to continual use by children. The extended type of consultation, as opposed to in-between-class consultations, should be used the majority of the time, since parental visitation will more than likely be infrequent.

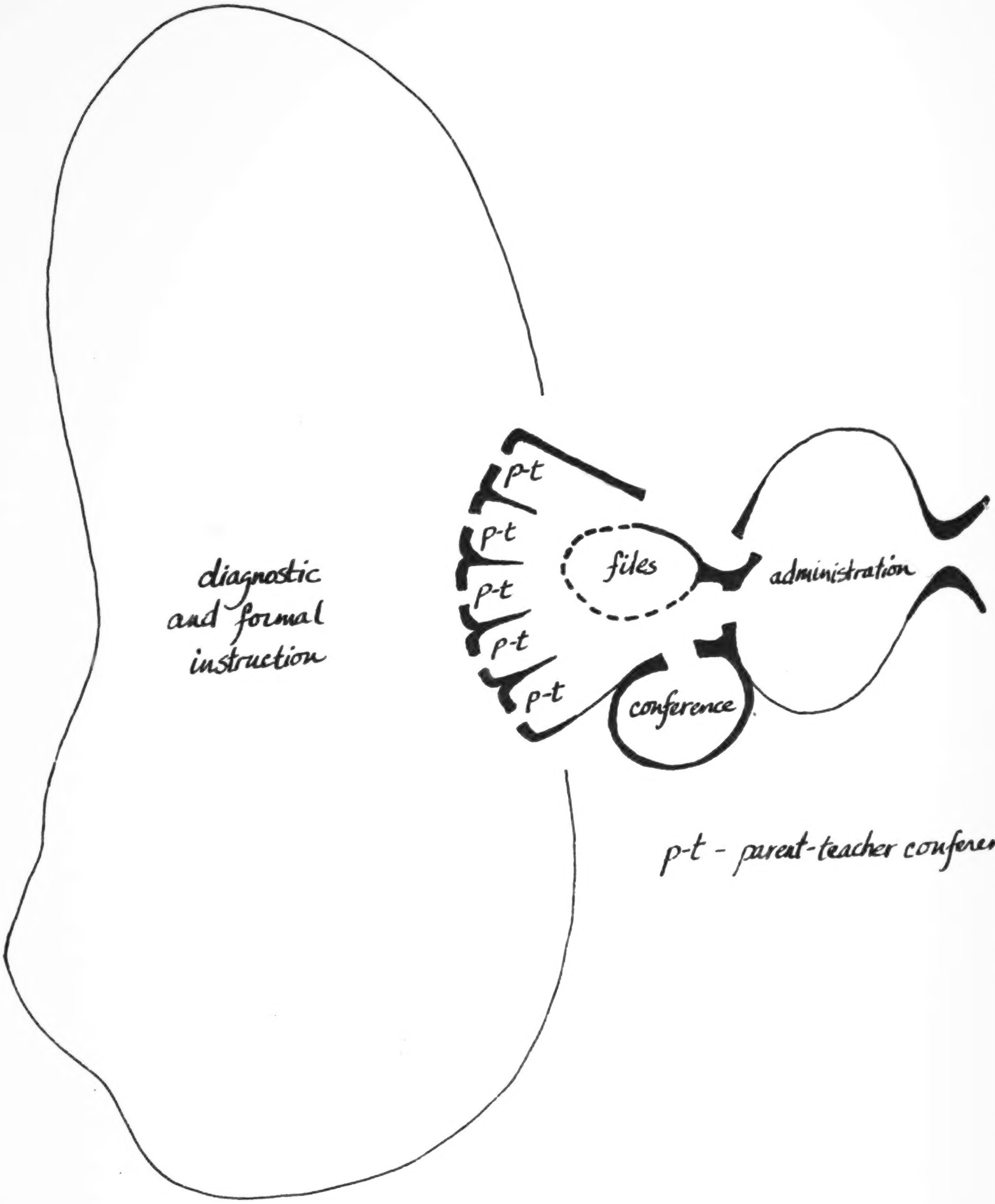
The parent should also become active in extracurricular activities. His role would be flexible varying from an observer to an assistant supervisor. The consultation with teacher/therapists should be as informal as the activity itself.

Administrator: He should be primarily an evaluator of the system -- evaluating the general programs, the various techniques being used in the classroom, and diagnosis. He should feed back information to the staff on the overall effectiveness of specific programs. He will be compiling rather extensive quantities of reports and statistics, which must be accessible to him and the staff in the course of their work and during consultations. His accessibility to the classroom and other activities instructing students should be limited to observation; therefore, his location with respect to information and staff is primary, and his location with respect to the activities is secondary. His relationship with the staff should be close -- perhaps sharing the same diversion areas and information centers.

In addition, the administrator will be in contact with the blind students by an overlap of activity in non-structured areas, which are not defined in this subsystem.

Teacher/therapist: Contact with the administrator through consultations and conversation with other teacher/therapists indicates a need for his removal from his teaching tasks long enough to get a proper perspective of the entire educational program. Consultation with parents and working with them on extracurricular activities will help insure success and a more thorough understanding of the program. Lengths of time and frequency of consultation are inversely proportional.

Form Solution: The form solution derived from the preceeding discussion concerns primarily the relationships within an administrative complex. Parents are brought into the school through an administrative checkpoint. From here they may procede to conference areas with staff members (particularly teacher/therapists) in areas adjacent to but not within the diagnostic and instructional areas of the school. Information on each child is easily available to these conference areas, as well as to a general conference area for administrative and staff use. The administrator has a separate access point to the school.


diagnostic and formal instruction
p-t
p-t
p-t
p-t
p-t
files
administration
conference

p-t - parent-teacher conference

REQUIREMENTS:

2. Parents who don't know how their child is developing in school will often retard this development with inconsistent training.

60. If teacher-therapists do not know how a child is applying what has been taught, they have no way to assess his progress or potential.

61. Because most visitors are inquisitive, their presence often disrupts the educational processes.

64. Observing manifestations of blindness which appear abnormal to him may reinforce a sighted person's discriminatory tendencies and/or prejudices about the blind.

69. If parents do not understand the procedure for their child's diagnosis, they may neither accept the diagnosis nor support the prescribed therapy.

70. If a child discovers his problems being discussed by others, his subsequent actions in their presence may become inhibited or hostile.

71. If a blind child realizes his actions and reactions are being observed and evaluated, he often feels he must exaggerate his behavior.

75. If a child feels that his contact with teacher-therapists is limited to structured activities, he will hesitate to seek their advice outside those activities.

76. If a child does not feel that aid he is seeking and receiving will remain confidential, he may neglect to seek aid for fear of social stigma.

80. If a teacher-therapist is denied occasional diversions from his work, his physical and/or emotional exhaustion will make him less effective in his work.

84. If a parents role in his child's development is being usurped, he will neither cooperate with those who are ursurping his role nor support their program.

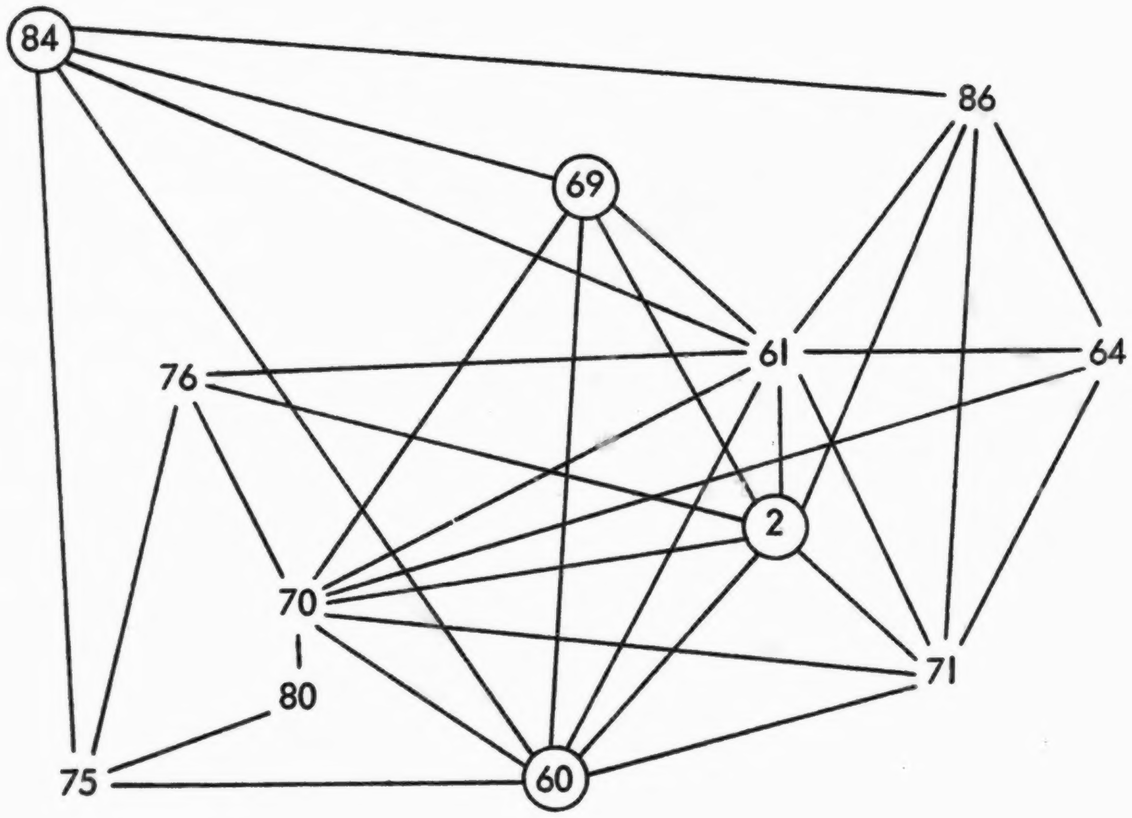
86. If visitors are given a distorted or incomplete image of the educational program, the constructive value of their presence is questionable.

P

Relational Topic

This subsystem deals with the integration of parents into the school environment, the relationships between teacher-therapists and the parents, and relationships between teacher-therapists and the child.

Lattice


84
86
69
76
61
64
2
70
80
71
75
60

Subset 1: (2-60-69-70-71-84-86)

Solution Statements:

1. Teacher-therapists should be able to talk to children in private about their home life. (2-60-76)
2. Teacher-therapists should be able to take part in any diagnostic procedure, in order to obtain information about parent-child relationships. (2-60-69)
3. Parents should be able to take active part in any diagnostic procedure. (2-60-69)
4. Therapy implies an on-going diagnosis: parents must realize that teachers and therapists continue to appraise the child's abilities, and must be in a position to cooperate with them in these efforts. (60-69-84-86)
5. During any diagnostic procedure, the child must not feel that he is being "discussed" in a manner that may lead him to imagine that his parents are "plotting with the staff to abandon him". Active participation, or at least the presence of, parents may help to alleviate these fears. (69-70-71)
6. If private discussion between parents and staff is necessary, the child should be encouraged to seek diversion in a way that would not arouse his suspicions. (69-70-71)
7. Parents must not be made to feel that they are "giving up" their child to a "foster home", "home for wayward children", etc.. (69-70-84)
8. Teacher-therapists should be able to confer with parents at regular intervals with or without the child present. (2-60)
9. Parents must be able to visit the "school", to have discussions with teacher-therapists, and to observe the behavior of their child in educational or therapeutic activities. (2-69-86)
10. Parents should be able to take an active part in formal therpay or academics (if such would be valuable to both child and parent), without disturbing the therapy or academics of other children. (2-69-70-71)

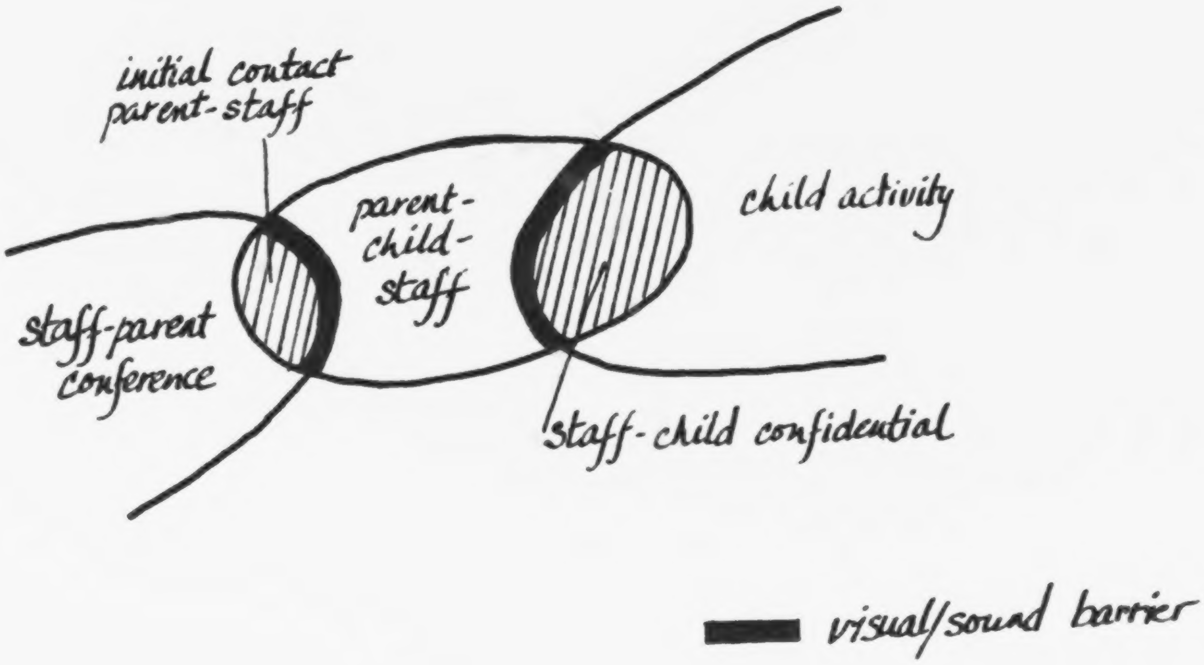
Form Solution: Some diagnostic procedures must be intimately connected with therapeutic and academic procedures. Teacher-therapists should be, at least for some aspects of the diagnosis, the diagnosticians,and for other more formal aspects to be participating in the sense of learning about the child that they will subsequently be treating. The formal part of the diagnostic service will presumablly be performed by people other than teacher-therapists, perhaps "experts in other fields", consultants, etc. Teacher-therapists must be able to consult with these people. Parents should take part in any formal diagnostic procedure because in many cases they are intimately connected with the child's secondary problems and additional handicaps, and through participation can perhaps be encouraged to support therapy. Parents and teacher-therapists should participate together because this will most likely be the initial contact between them and the child's prognosis and its connection with parental support of teacher-therapists' efforts can be discussed.

The requirements and interactions strongly suggest that anything like a "waiting room" be avoided -- where "new" parents and child would have to come in close contact with other parents or visitors or where fanciful speculation on the part of both parent and child may disrupt subsequent procedures. A new parent and child must be able to make immediate contact with attending staff. After initial contact with staff, parents should be able to talk to other parents. It is possible that several parents and children would be present at the same time.

Where group-focused activity such as group recreation, extracurricular group activities, etc. is in progress, the parent can participate as a observer or as an "assistant supervisor". In either case, no barriers between child and parent are necessary; possibility of parents disturbing children would be minimized by 1) focus of children's attention on dynamics of group activity and 2) direct involvement of the parent in the activity. With parent participation, teacher-therapists would be able to demonstrate therapy/training procedures, child's abilities, etc., and parent-staff communication concerning children would consist of direct, first-hand experience for parents. Teacher-therapists would also be able to observe parental behavior and reactions to children.

Where children are working individually under supervision of a teacher-therapist, parent involvement must be effected by separating participating parent and his child from other children or by focusing attention of other children away from participating parent and child.

If it is necessary that the child must work totally undisturbed, with minimal distraction even from teacher-therapists, then parental observation or participation is probably impossible. Knowledge of child's behavior or progress and an understanding of the treatment procedure will have to be obtained by parent vicariously through explanation and conference with teacher-therapist.



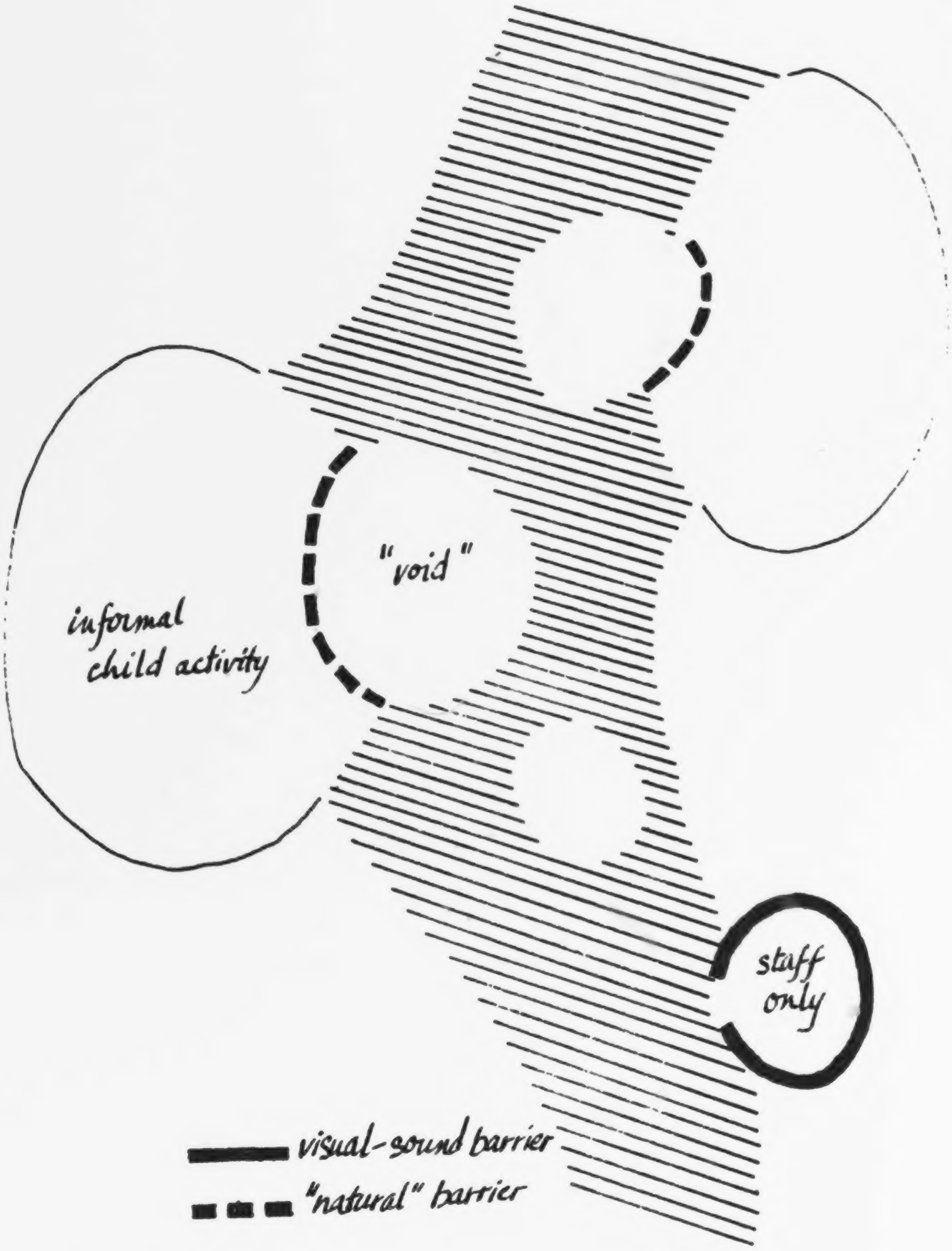
Subset II: (60-70-71-75-76-80)

Solution Statements:

1. Teacher-therapists should be able to observe children outside formal situation without the children knowing it. Children should not be made to feel that they are being observed. Thus, provision should be made for the child to be "naturally" engaged in some activity, so as to divert his attention away from those who may wish to observe his behavior. (60-70-71-75)
2. Teacher-therapists should be able to talk to children in surroundings perhaps more informal than the "classroom". (60-75-80)
3. Observation (vantage points) used by teacher-therapists must not be designated as such. That is, if a child becomes aware that teacher-therapists have special places from which to "bug" him, he may affect behavior that doesn't reflect the true state of his progress or handicap. The primary function of these observation or vantage points should not be "observation", but rather such functions as staff lounges, snack bars, dining areas, offices, and other communal areas which serve as staff diversion areas and where "observation" can be disguised. (60-70-71-80)
4. An awareness of the child's problems can be increased as the staff member increasingly gains the child's confidence. Children should be able to consult staff members on an informal basis, and in private if necessary. A child should not be forced to acknowledge that he is talking or has talked to a staff member privately. (60-75-76-80)

Form Solution: Staff-child confidential areas must exist as places where staff members and children desiring privacy to discuss can "slip in and out" easily and quickly. They must exist as an adjunct to places where staff members and children "naturally" (routinely) go outside of structured activities. If noise generated by an activity itself is used as a "barrier", then a "confidential area" must be far enough away from activity centers so that noise does not act as disturbance, but rather as a "barrier". As the activity becomes more quiet, the "barrier" can move closer but has to become more solid.

The staff must find occasional diversion from their work and become involved in something of interest other than immediate tasks. In addition to the non-formal diversion with children mentioned above, they also need an area with a sound-visual barrier between it and other staff, visitor/parent, or child areas. They also need contact with other staff members, without inadvertant disturbance by children or visitors/parents, while still maintaining at least visual supervision of children. Because the staff-child and staff-parent confidential areas must occur at virtually any location within the school, the creation of random "voids" within the circulation system utilizing noise and placement as "barriers" satisfy the basic needs described above. These are augmented by a few specific areas which would be more isolated and primarily for staff use only.

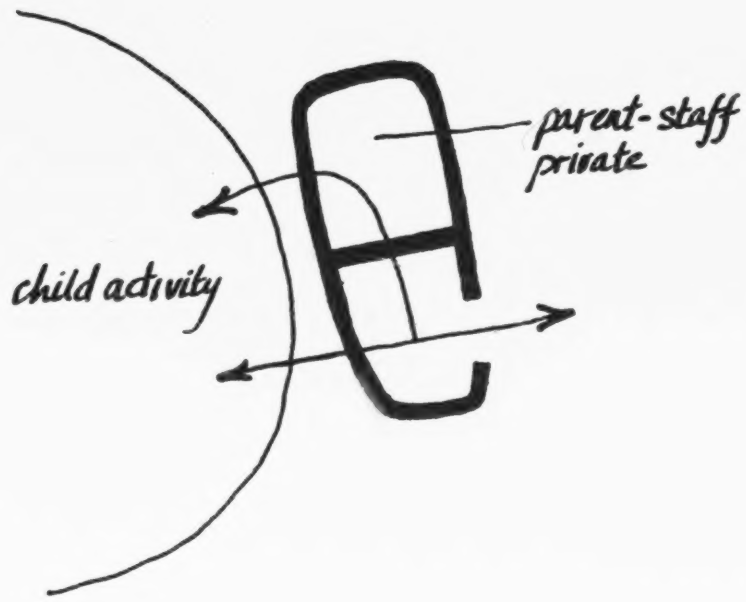

"void"
informal child activity
staff only
visual-sound barrier
"natural" barrier

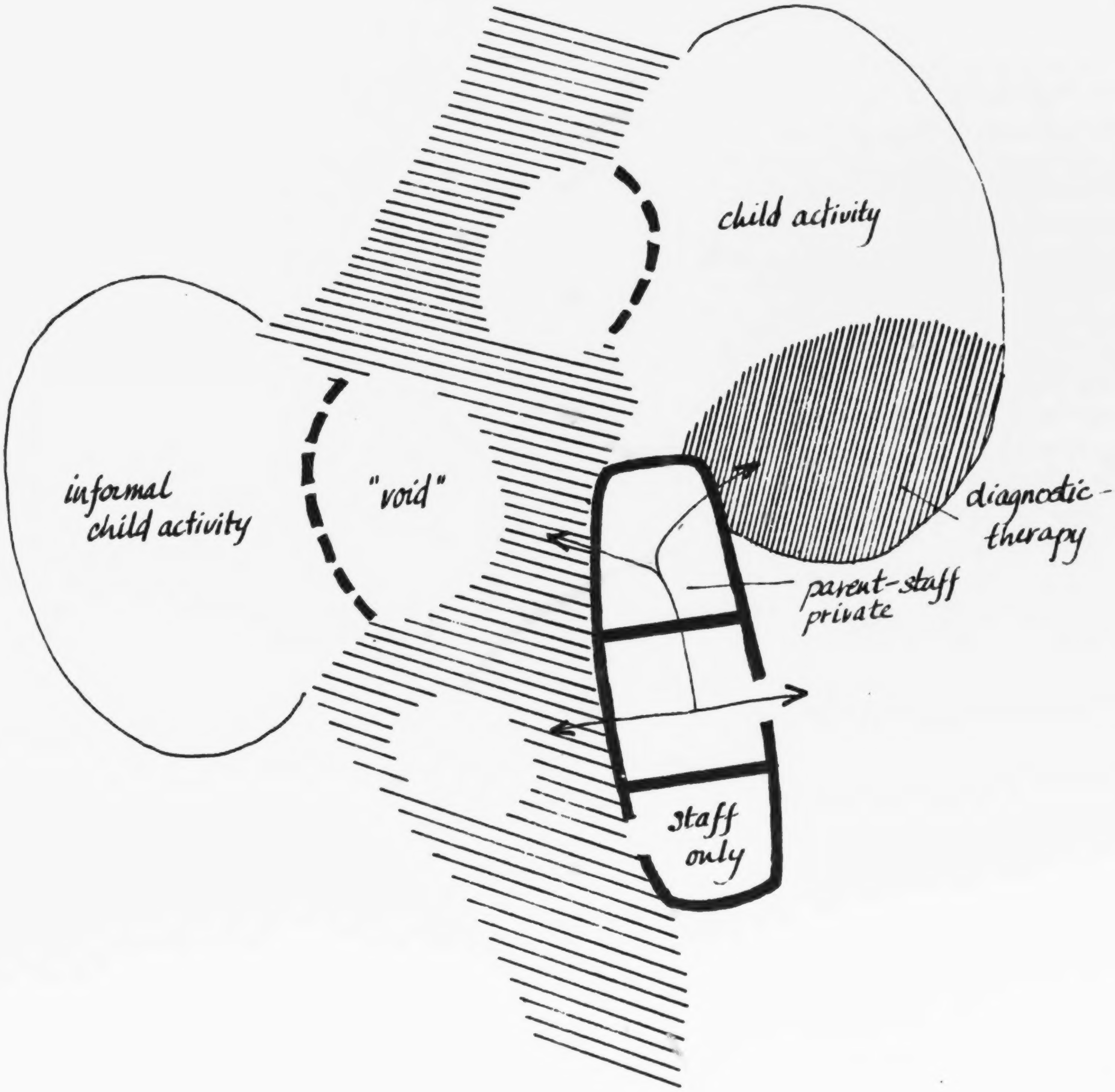
Subset III: (2-61-64-70-71-86)

Solution Statements:

1. Teacher-therapists should be able to confer with parents, at regular intervals, with or without the child present. (2-60)
2. Parents should be able to visit and leave the school without the child's knowing it, i.e. to discuss the child's progress or problems with staff without the child's awareness. (2-70-71)
3. Visiting parents should not be able to inadvertently disturb any child, whether his own or another's, who is engaged in any formal therapy or academics. (61-64-70-71)
4. Parents must be able to confer with staff members (with or without the child present) and not be disturbed or inhibited by the presence of other visitors, other staff members or other children. (2-61-86)
5. If private discussion between parents and staff is necessary, the child should be encouraged to seek diversion in a way that would not arouse his fears or suspicions (of being "discussed" or "plotted against"). (70-71)

Form Solution: Consultation between staff and parent must take place without disturbance from other staff, visitors or children. But because parent participation or observation may follow private conference, proximity of children activity to private conference is necessary as well as proximity to records, examples of child's work, etc. Parents must be able to enter or leave a private conference without the child's awareness. If consultation is co-temporal with child activity, then private conference must be separated by sound-visual barriers. If consultation is not co-temporal with child activity, then parents and teacher-therapists can take advantage of child-activity areas for conference. Informal conference, with or without children or other staff members, can be effected in staff diversion areas, parent-visitor "reception" areas, or transition areas.




child activity
informal
child activity
"void"
diagnostic-
therapy
parent-staff
private
staff
only

P

REQUIREMENTS:

2. Parents who don't know how their child is developing in school will often retard this development with inconsistent training.

7. When a blind child knows his activities are continually supervised, he does not develop self-reliance.

38. If a blind child is not allowed to gain experience outside his customary environment, his dependence on that environment is increased.

51. If a blind child is compelled to learn or react at a rate not suited to his abilities, he will become inattentive or resistive.

55. When therapy or remedial education is piecemeal or discontinuous, the regressive tendencies of the mentally-handicapped blind child are unrestrained.

66. If a child's communication with people is limited to a fixed group, his motivation and social development will be retarded.

79. If a child's progress requires that he break contact with those who have been helping him, adjusting to their absencemay retard his further development.

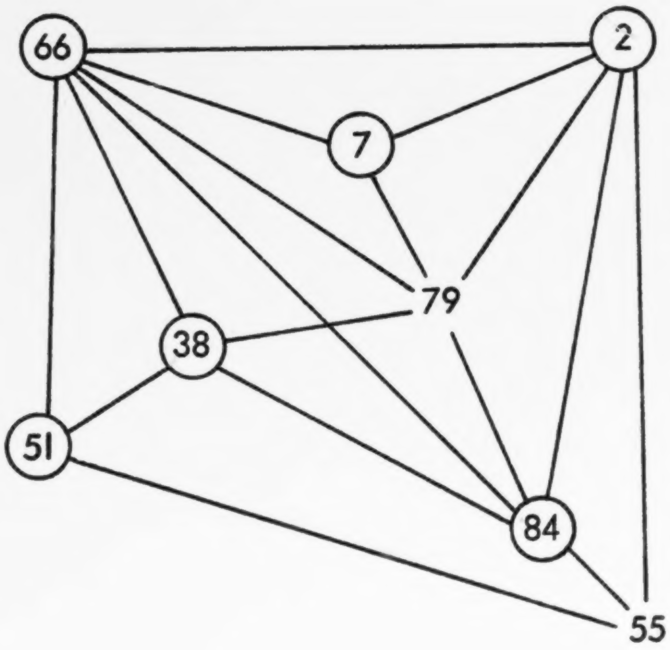
84. If a parent's role in his child's development is being usurped, he will neither cooperate with those who are usurping his role nor support their program.

Q

Relational Topic

This subsystem deals with the relationships between parents and staff members, parents and children, and children and the community.

Lattice



Discussion;

The subsystem requirements were analyzed by examination and interpretation of the subsets of interactions found in the lattice diagram.

The simplex 2, 7, 66, and 79 forms subset 1. It can be characterized as requiring some compromise between the need for a stable emotional context or framework within which the child can operate securely and the need for exposure to varying personalities with their respective values, demands, attractions, and outlooks as models.

Resolving these needs implies that there must be an evaluation of a child's relationship first, to the home environment supplied by his parents and secondly, to an educational environment in which he might live. Where parents are not overprotective and are able to satisfy his needs, and ties between them and the child are strong, the need for variety in contacts is probably best provided with staff members and other children in an educational context. Parents would need frequent and continued contact with staff members, even though they were initially understanding of their child's needs. The child's development could produce new role demands of the parents which, without guidance from those treating and educating their child, they could either misperceive or be unaware of. If the parents are, for some reason, unable to care for the child or if geographical distances make his care unlikely, the child may need the stability of an education-care facility which could be provided by the school. In this case, maintaining close contact with parents would become a mandatory function of the school. To reduce a child's possible introversion in an imposed home such as this, he should be encouraged to develop strong ties both within and outside of his normal academic associations (other children, staff members, etc.), and he should be able to establish ties with others outside the school environment.

In subset 2, requirements 2, 38, 66, 79, and 84 complicate the relationship between parents, child, and staff. In 38 and 66 a need for experience with different people and situations is required, while 2, 79, and 84 strongly temper the need with the feelings of the parent and the child's psychological demand for a basic set of stable, trustworthy relationships.

To effect the stability and flexibility indicated, the child needs to maintain close ties with his parents (where such ties do not become detrimental to his progress) and with others in whom he trusts, relies, or feels affinity. He requires, in addition, other contacts than those stable ones, but will gain most benefit if he can form new associations while maintaining his accustomed ones (with parents, peer groups, etc.). Parents must be an integral part of any educational and therapeutic program and they should, whenever possible, be able to take responsibility for decisions concerning their child.

Requirements 38, 51, 66, and 79 of subset 3 reiterate the needs for contact outside either familial or peer group contexts but emphasize the importance of retaining personal associations and ties with familiar environments. In addition, the child should be able to indicate his willingness to experience new environments; his cooperation is essential to development but will be difficult to receive unless he is ready to give it.

Requirements 2, 55, 79, and 84 form subset 4, again emphasizing the need for close contact between the school and parents, but in this case, the parents of the mentally handicapped. Whether or not a parent can care for a child, there is a great need for educating and training the parents of a mentally handicapped child, and if his training takes place outside his home environment, preparing them for his eventual return. Their cooperation will, again, be more easily obtained if they share in the responsibility for decisions concerning the child's treatment. The subset also implies that there must be an evaluation of the parent's abilities to care for a mentally-retarded child; no matter how well intentioned, some parents will be unable to provide the continued care required. Providing a stable environment for him is mandatory and demands that the child be immune to parental whim of caring or not caring for him. Additionally, a mentally-retarded child will require remedial education and therapy whether or not there is an official "school session". This implies that either care is provided on a year-round basis or that there be facilities and organizations capable of keeping in touch with the child when he is outside the protective environment of the school.

Final Form Solution:

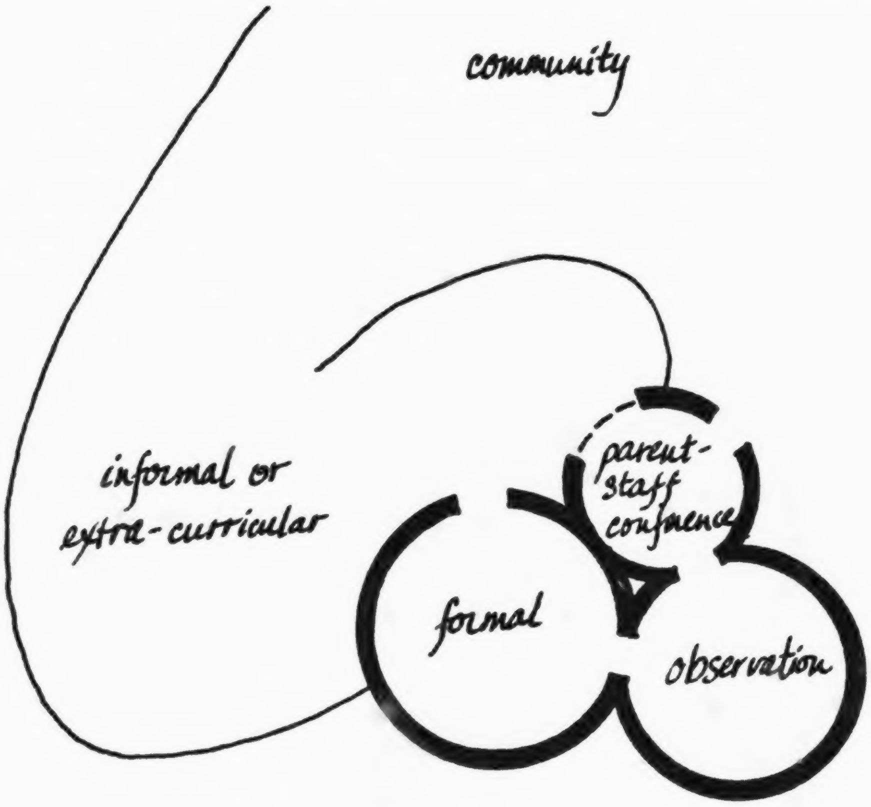
The necessity for continued and frequent contact between staff and a child's parents can be met in part by the conference area indicated on the diagram. From this area a parent can observe his child in interaction with other children. Observation functions as an area in which a parent-child relationship can be evaluated in operation. After determining the child's diagnosis and prognosis, he begins working within the formal activity area. The relationship between his formal and extracurricular activities exists not only through form, as indicated on the diagram, but also through emotional ties with his formal and school environment. It is through his extracurricular activities that he has the opportunity to experience both new environments and new individuals ("community" in the diagram) while being able to associate each with his normal school environment.

Not included in the diagram, but extremely important to this subsystem, are its policy implications. Initially, there must be an evaluation of the parent's ability to provide a suitable environment for their child. Observation within an imposed "home environment" will not replace knowledge of the way in which children are actually treated within a familial setting.

For many multiply-handicapped children (and within this context, particularly the mentally-handicapped) the need for continued therapy and remedial education is not dependent upon a seasonal scheduling of classes. In addition, parents who for some reason cannot care for their children will be more apt to participate in a program where they are made to feel an important part. While letters informing them of a child's progress may give them information, personal contact indicates concern for their problems. For these reasons, then, there must be diagnostician-therapists who will act as liasons between the school and the child's home.

There should be a program to educate the parents in the processes of diagnosis, therapy, and education, emphasizing their roles in helping the child develop. This would ideally be carried out both at the school where children can be observed in daily activities and within the community or home.

Any program attempting to provide continued therapy and education for children from diverse backgrounds must accept the responsibility for the total care of some. To effect such a solution the school becomes in part a residential facility. Because the child's need for a stable environment is so strong, the school should provide residential facilities for most children who do not remain within their homes. When children can tolerate a more flexible environment, a "second home" within the community could provide diversity in contacts and the opportunity for becoming more self-reliant.


community
informal or extra-curricular
parent-staff conference
formal
observation

Q

Key Interactions and Form Solution Statements:

The following is a discussion of those key interactions that were joined as the three subsystems were combined into one system.

-(3,4) : (13,18): Solution range concerning the stability of objects (stimuli): If there are going to be moveable objects then they must be limited to certain areas. The blind child must have complete control over the objects he frequently encounters; namely, his own personal objects. Objects that are moved should not be placed where they can injure the blind children, e.g. certain circulation areas, big play areas, etc.

-(1,46) : (4,15) (5,43) (13,46) Basic structure of school is stable while more specific parts change.

-(3,13) : (15,54) Any changing environment must be surrounded by a stable environment. (Important for Subsystem A)

-(4,43) : (15,54) (26,62) Make child aware that he is entering a significantly changing environment. So long as the blind child's environment is structured so that he knows what to expect, the rate of change is irrelevant.

-(4,54) : (13,22) (22,25) If it is required that the transition between two areas must be quickly and easily navigable, then the transition area must be very simply changed, (such that the change is easily perceived and comprehended).

-(4,74) : The organization of the class should be stable but not necessarily the physical entities within it. The blind child should not have to move his classroom location to obtain personal class materials.

-(5,25) : Give child practice in coming across unfamiliar stimuli, but put it in an environment where it will be safe for the child to explore.

-(12,29): Have circulation pass through a new or intensified environment from which the child can learn.

-(26,57): Simple environments should not restrict child's movement. In strange environments, however, you should have some way of providing him with safety.

-(29,40): You make the circulation system exist between class areas so that practice in mobility makes the transition between the class areas productive.

-(46,52): When in areas without supervision, potential for serious injury should be at a minimum.

-(4,15,54): Within the blind school, the stable structure should be the basic circulation area.

-(4,54,74): If it is necessary for a child to move between various activities in the classroom, he should be able to do so quickly and easily, using the various stable elements of the structure to guide him.

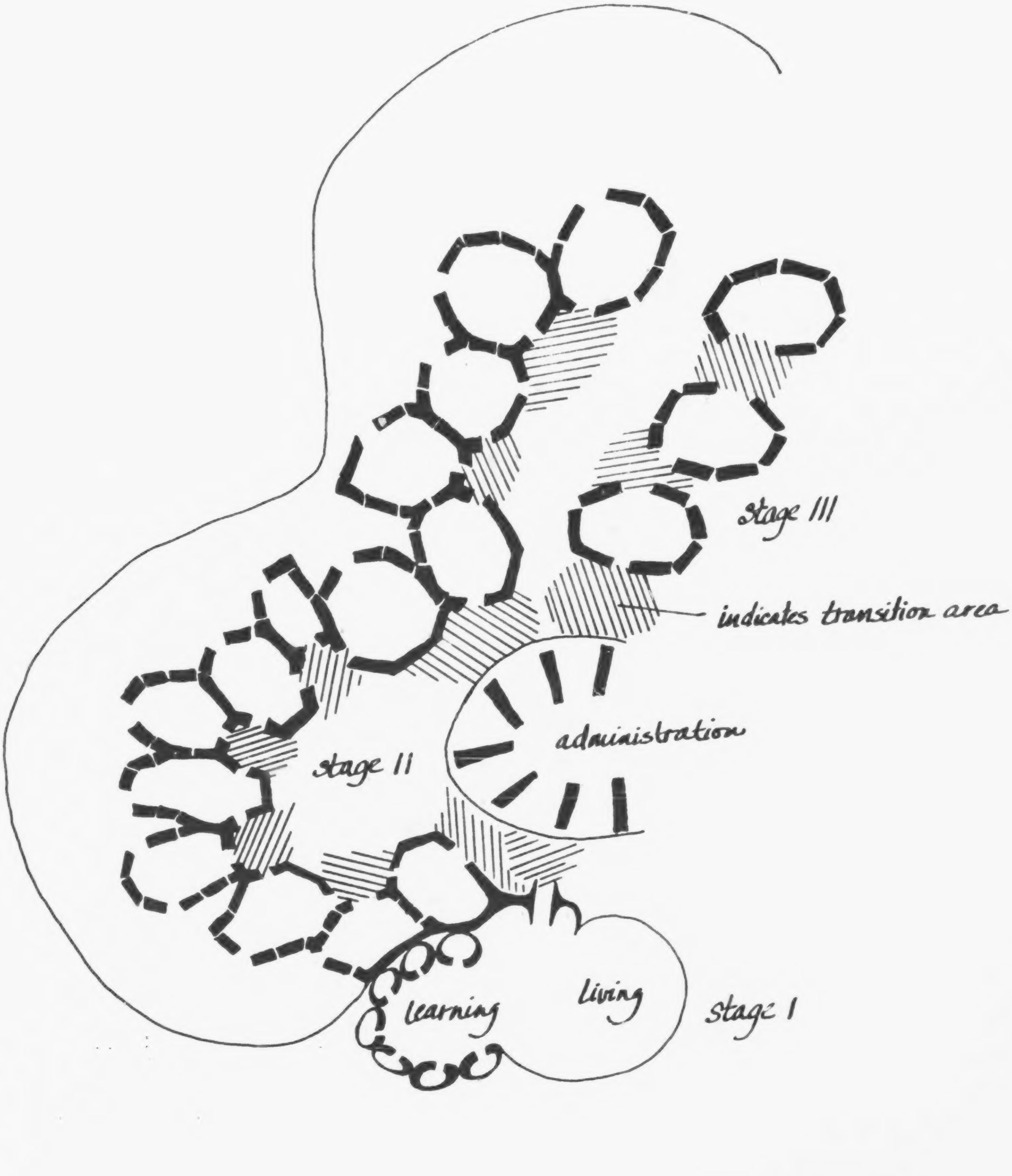
-(26,13,46): The "home" environment of the hyperactive blind child should be so controlled (supervision, safe, etc.) that it will be very difficult for the child to hurt himself. When outside this environment he should be provided with mobility aids to ensure his safety.

Form Solution:

In the combination of subsystems A, B, and C each subsystem dealt with the structure of the school environment on a different scale and with different considerations. Thus there were no major conflicts; rather there was a meshing or integrating of the different levels into one solution. The addition of the "missing links" brought in new information and led to a modification of the combination. 'A' was concerned with the organization of the school on a gross level, considering safety. 'B' was concerned with the physical detailing of the school in response to a childs need for orientation. 'C' was concerned with the structure of individual activity areas and circulation areas and how this helped in the development of a childs understanding of the structure of an environment.

Putting the three subsystems together, several new concepts formed.

1. To help a child understand his orientation in the school he must be able to have something to relate to quickly when he gets lost. Therefore, any complex area must be limited in size and surrounded by a simple, stable system with which the blind child is familiar.
2. The school is divided into groups of activity spaces that relate to a single area or system.
3. The basic structure of the school must be stable (not changing).
4. The "normal" blind child should not be continuously restricted to specific areas within the school.
5. Basic circulation systems should change only slightly and should be the stable element within the total system.


stage III
indicates transition area
administration
stage II
learning
living
stage I

ABC

DEF

Combination of Subsystems D, E, F

The combination of these three subsystems defines the activity space, what is needed to enable activities to function therein, an elementary relationship between one activity space and another, an elementary definition of a therapy space, transition spaces,and informal activity space, and the relationships between these.

This subsystem includes 35 requirements, which have been covered in the discussions of subsystems D, E, and F. Since there are interactions between the requirements of one subsystem and those of another, interactions of this nature had not been discussed prior to combining these subsystems. This combination contained about 25 of these missing links with the greatest majority occuring between subsystems E and F. Upon examination, most of the missing links were found to have been covered in one form or another within the subsystems and therefore will not be elaborated upon here.

Certain conditions arising from the subsystems were used to effect the combination. There were two sets of conditions, one for the intensive care, including hyperactive, the other, upper level, included children in the latter two activity catagories of subsystem D. The ordering of the activity areas was drawn from subsystem E and F. The therapy area and concept of informal area was introduced from subsystem E. The transition concepts were from all three.

The conditions derived for the intensive care level were:

- For the young blind child and for the hyperactive blind child, there is a need for diagnosis and observation.
- There should be a low student/teacher-therapist ratio: for the intensive care blind child, 5/1 to 8/1, for the hyperactive blind child 3/1 or 4/1.
- All areas are highly safe, all transitions are supervised, blind children are not allowed access to older students's areas and visa versa.
- All areas are supervised. An assistant or volunteer should be available to help with supervision.
- All object positions are fixed or static.
- Storage is provided for group. Supervisor distributes and collects small objects.
- A hyperactive control space is used occasionally for hyperactives who should be temporarily isolated from either too rich a stimuli or danger to self and others.

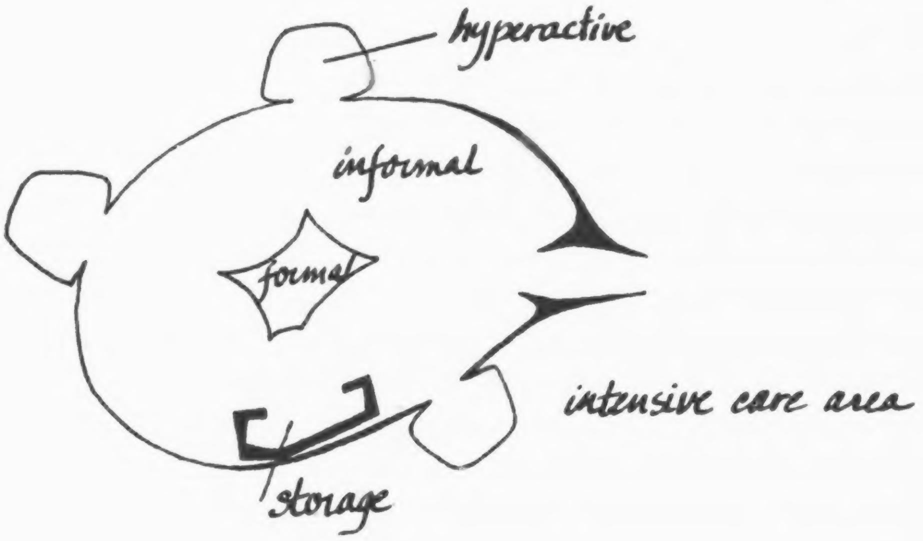
The conditions for the upper levels were:

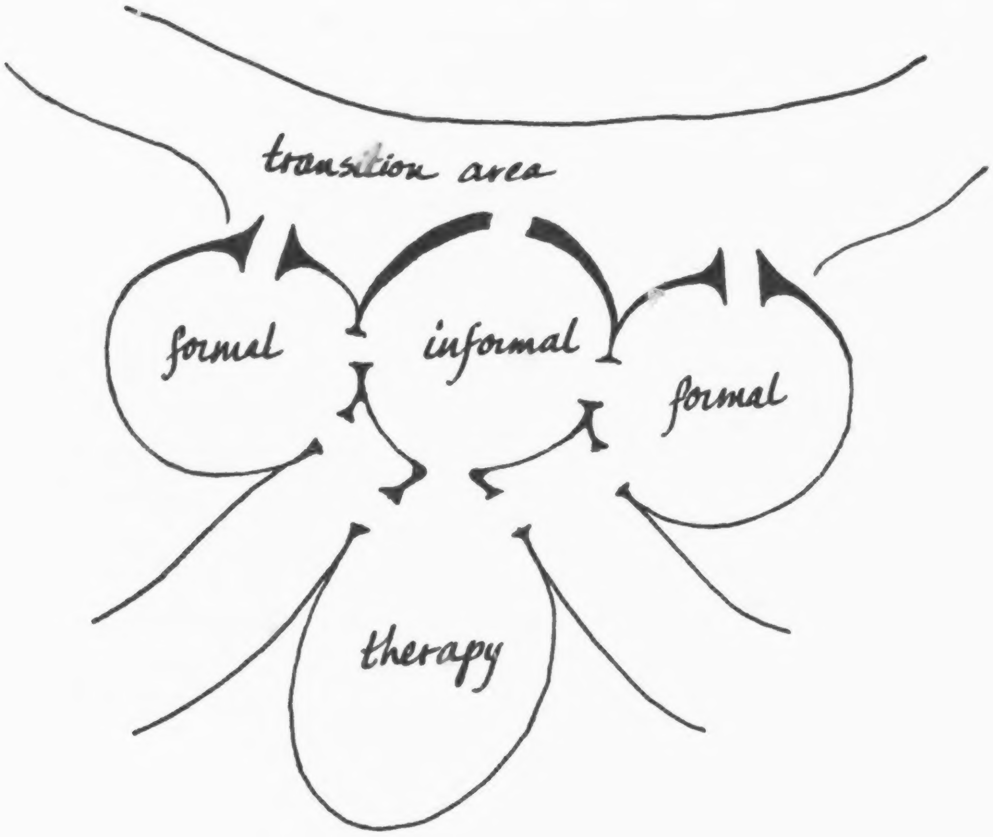
- Objects must not change position often, and major objects should change, or be moved, in a non-surprising manner.
- Types of stimuli desired: basic, dependable inputs, and varying, enriched superstructure with no ambiguous forms nor distracting stimuli in activity area.
- Circulation: no congestion permissable; cross traffic allowable; movements should be nonconfusing and beneficial.
- Storage: accessible, private, quick and convenient use; no carrying or migration of objects beyond immediate area; strong object-location identification.
- Supervision: should be for small groups; should determine where blind child is at all times; for movement of large or dangerous objects; in the form of observation for private areas.

- Therapy uses same informal area as the classes do.
- Each blind child is provided an individual, private place in which to work.

Form Solution: In the combination two areas are specified, an intensive care area and a more general upper level area. The two represent, among other things, the extremes of the system. The intensive care area is for blind children who have just entered the system who possess none of the required mobility skills, development, or advanced education to exist in the upper level. The intensive care area develops just these, and keeps the blind child only until he is advanced enough to proceed to a higher level. The area itself has two unstructured, and therefore not precisely located, activity areas, one formal, the other informal. These activities may overlap or even occur where the previous one has just taken place. The group storage unit provided is administered by the supervisor. The supervisor also controls the access to the area. In those areas for the hyperactive blind children, the same informal-formal relationship of the intensive care blind children is provided. The major difference in the hyperactive area is that the formal area includes individual student spaces that provide the child with a stable, stimulation-reduced environment. The hyperactive child is placed in one of these spaces when he is unable to continue function ing in the more normal environment of the larger areas. Both teaching and therapy may occur inside this space.

The upper level consists of a formal area, informal area, undefined therapy area, and transition area. Of the five areas, the informal area is central to the others. The formal areas are linked to this informal area in order that a supervisor, from the vantage point of one of the formal areas, can observe the blind child in his informal activity. The therapy area adjoins the informal area for the same reason. The therapy area also uses the informal area as a transition from the formal area.


hyperactive
informal
formal
intensive care area
storage


transition area
formal
informal
formal
therapy

DEF

FGH

Combination of Subsystems F, G, H

The first step in combining subsystems F, G, and H was to investigate the form implications of the interactions between the three. The form implications of each of these forty-five new interactions was then checked against the individual subsystems to see if it was already solved by one of them. Those form implications not previously accounted for are listed below. They were used to give additional insight into resolving conflicts between subsystems or to initiate alterations within the combination.

- (H - F) (36, 17)	Introducing the blind child to a new physical organization or process calls for isolation from sounds for those activities which are dependent upon their own sound. Also, if verbal description could disrupt others, the act of description must be audially isolated from other activities which are dependent upon self-generated sound.
- (H - F) (36, 65)	When verbal descriptions are necessary, groups of students must be small.
- (H - F) (36, 74)	All materials to be used by a teacher-therapist must be close at hand and easy to use. Adequate space for demonstrating physical organization and process must be available. Whenever possible a process must be demonstrated simultaneously to as many blind children as possible (this implies a small group, since only a very small number of children can take part in a demonstration). Also-implied: more object storage than in school for sighted, since all explanations concerned with objects should use objects.
- (H - F) (53, 65)	Keeping groups small will reduce need for simple supervision and increase teaching-therapy attention. Limit distractions created by too much space to wander about in. Too many loose objects and sounds unrelated to the activity will also help reduce need for supervision and sense of being overly supervised.
- (F - G) (4, 47)	Blind child must have choices with fixed variables. i.e., if he is accustomed to making a choice between two paths when he reaches a certain point, new choices or different ones should not be introduced.
- (F - G) (10, 51) (10, 62)	The blind child should have an environment consisting of forms with clear purposes until his understanding of form is better developed. Then he should be exposed to conflicting form at his own rate of development.
- (F - G) (29, 12)	Changing classes should give students practice in orientation and mobility.

Discussion: In the combination of F, G, H, Subsystem F remained a well-defined activity area unaltered by the form relationships of either G or H. Similarly the relationships in H were additional elements of form which remained unaltered. Subsystem G, however, added no new elements to the combination, but acted as a general organizing principle which gave the elements of F and H spatial organization. H defined the boundaries within which this organization took place.

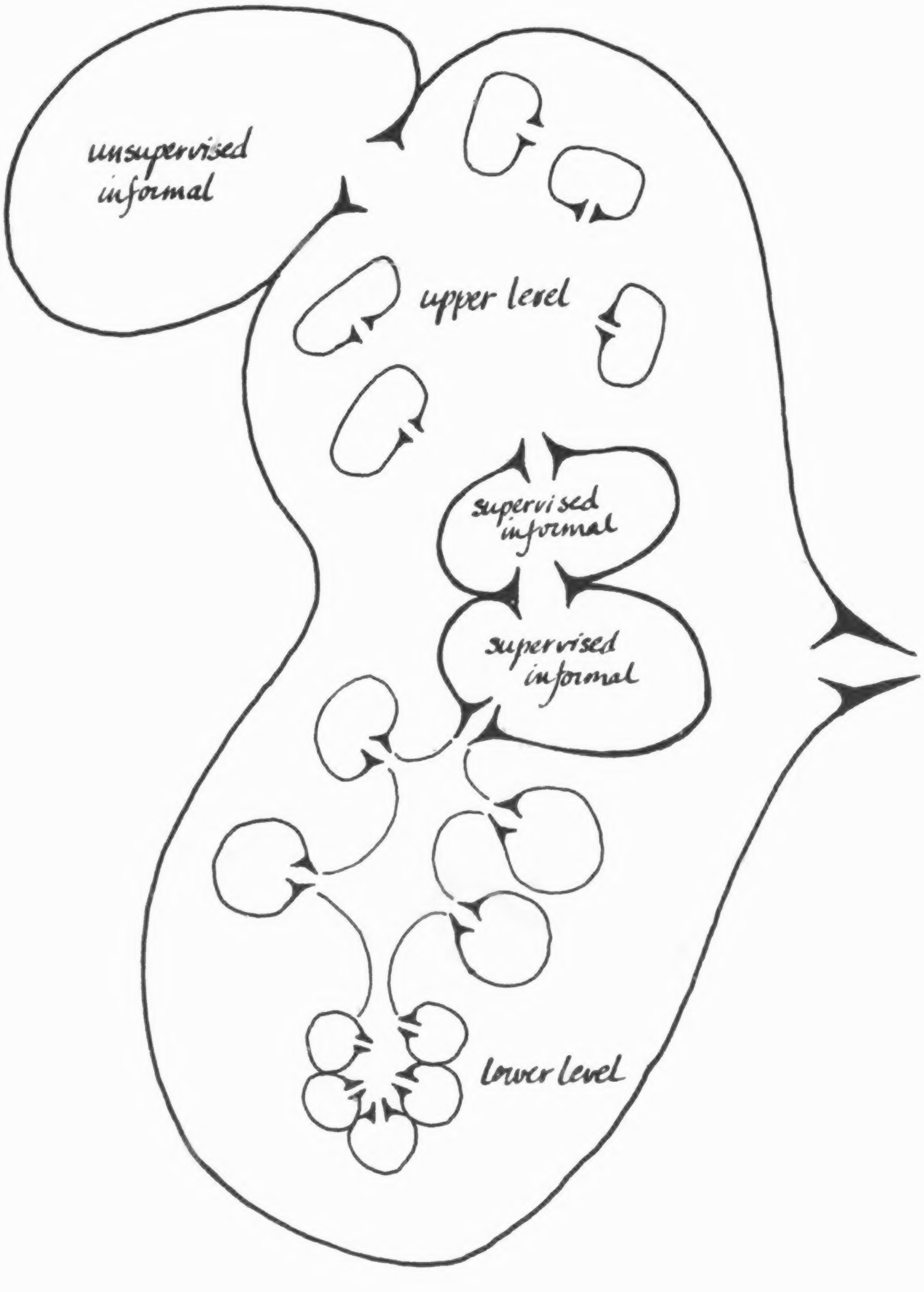
Subsystem F gave specific form to formal activities, and G dictated the placement of them relative to each other by calling for a distinct separation of each by an area of non-supervision. G also called for continual supervision for the child who could not operate alone; therefore, when combined with F it introduced a confined area of class activities for these children.

The minimally supervised, free play area,called for by H, concured with the need from G for experience in unsupervised areas for the able child, but conflicted with the supervision requirement for the unable child. This was resolved by creating an unsupervised play area for more capable children and a supervised play area for the others. Since subsystem G called for supervision of the more advanced children, they also have a supervised activity area.

The combination pointed out the importance for a blind child of lower capabilities to be exposed to children whose abilities are greater than his. To accommodate this the supervised play area of the more advanced child and the supervised play area of the less advanced child merge to allow mingling of the children. However, each activity area is geared to a different developmental level in order to create a division of the two areas without a physical barrier. This allows the less developed child to intermingle with the more developed children if he is so inclined.

Subsystem G described the development of the blind child in terms of the expansion of his known environment into supervised areas; Subsystem F implied that this expansion should take place within the framework of class activities. As the highly supervised blind child begins to develop, he is introduced to new class activities which require that the movement necessary to get to them be unsupervised. This unsupervised movement should introduce relatively limited ranges of choice. As he becomes considerably more developed he is given greater ranges of choice.

Subsystem H called for an exit point where the child could leave the school, and thus, implicitly called for a boundary defining the limits of the school.


unsupervised informal
upper level
supervised informal
supervised informal
lower level

FGH

IJK

Combination of subsystems I, J, K

This combination deals with the concept of developmental levels in which peer groups are defined as physical and mental equals. Control over a child's activities is strict at the lowest levels, becoming less defined at the upper levels. Sizes of groups are initially small and increase with changes in content of curriculum. Therapy area, particularly for psychotherapy, are structured to decrease preferential treatment and possible social stigma to any child, as well as to increase the chances for beneficial effects on the child. Staff conference areas provide a means to better information exchange on each child's problems.

The form implications of the key interactions between the subsystems are:

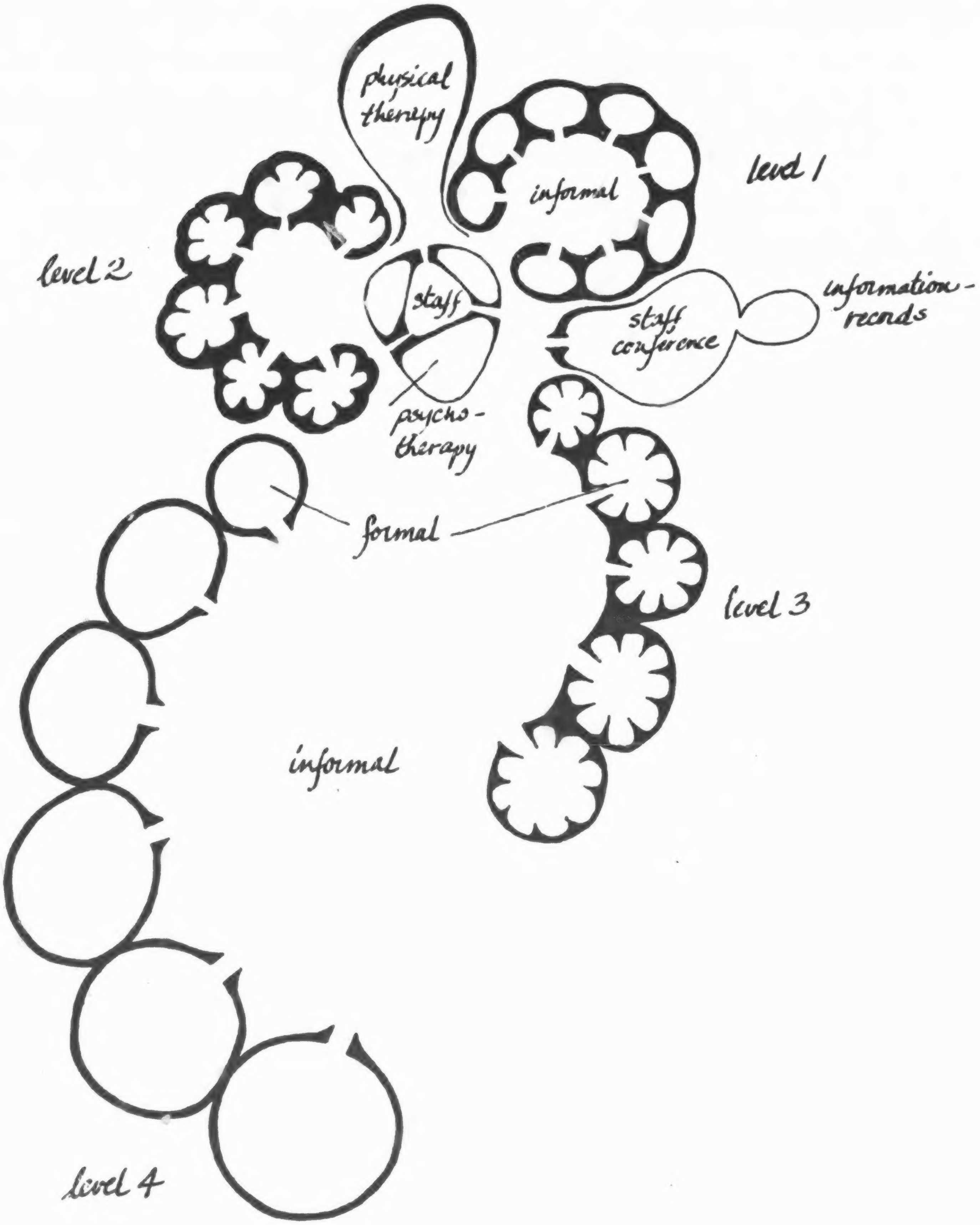
- Subsystems I and J: Activity areas should be structured such that the attention of the children is focused and maintained (7-23). Children should be grouped in activities according to physical and academic abilities (51-73). Activities should be highly supervised with close proximity between teacher and student; a supervisor should control access to diversions (33-90).
- Subsystems I and K: Children should be separated in formal activities so that they cannot disturb one another by talking (27-39). Constructive diversions should be provided near formal activities (65-90). Children should be exposed to a variety of groups, i.e., formal, informal, blind, sighted, etc. (51-66). Free-time should be spent with peers (83-89). Children should be encouraged to work on their own with little supervision, but teacher aid should be readily available (7-85 and 8-85).
- Subsystems J and K: Contact with the sighted should be natural, placing neither sighted nor blind in a disadvantageous position (32-59). Complex ideas requiring physical involvement should be taught in small groups (high teacher-student ratio) (8-36). Any child working individually should be able to receive immediate aid (8-85). Activity areas should be spatially bounded and structured such that group activity is encouraged and that the child is able to identify himself with the group (33-88). Group seating arrangements should not be hierarchical (41-88).

The following solution statements were generated from the subsystems in the combination and the new form implications:

1. Groups in formal activities must be in close proximity to each other in order to effect a child's participation in groups within his developmental level.
2. There should be a range of formal activities within any developmental level.
3. As a child develops, he should be encouraged to participate with a wider variety of individuals in non-formal activities.
4. The more formal the activity, the greater need for control of access to it, and the less choice a child should have in coming to or leaving it.
5. Semi-formal areas can be greater in area, not only due to the differences between formal and semi-formal activities but also because the needs for structure/supervision and the required teacher-student ratio are lower.

6. At higher developmental levels there are more formal activities than semi-formal; the formal activities are more specialized in content; higher developmental levels require more areas for formal activities since those activities are specialized.
7. At higher levels there will be less need for clinical therapy (assuming that emotional problems can be treated during development).
8. At higher levels there is less need for immediate aid/assistance than at the lower and less need for personal attention from a teacher-therapist.
9. At higher levels of development there is need for immediate access to therapy areas. (Therapy may still exist as an activity for those children, but they will have become able to get around successfully by the time they have reached this level).

Form Solution: The form solution for the combination of I, J, and K takes the general configuration of subsystem K, while I and J give order to the internal structuring of formal areas and indicate the locations for conference areas, therapy, and records on each child. The lowest developmental level contains bounded areas for formal/informal activities, with each small group area contiguous to an informal area. Physical therapy and psychotherapy relate directly to the informal area, the latter to reduce preferential treatment that might be implied. Similar areas for psychotherapy adjoins two other informal areas. These therapy areas define a casual staff conference area, to facilitate exchange of information on the children involved. A formal staff conference area with adjacent central information storage for the children's records links with the informal staff conference area. Three developmental levels are defined beyond the initial level. Each contains bounded areas for formal and "non-formal" activities (the latter called "semi-formal" activities in subsystem K), and all these areas lead directly to informal areas. Formal areas increase in scale in the diagram to indicate the increase in group size. At the final level, all bounded activity areas are for formal and/or specialized activities. Within the informal area at this level sighted children are introduced into structured informal activities with the blind. Individual activity areas within the formal areas take form according to the nature of the work required.


physical therapy
level 1
informal
level 2
staff
staff conference
information-records
psycho-therapy
formal
level 3
informal
level 4

IJK

LMN

Combination of Subsystems L, M, N

Discussion

The three subsystems coming together to form this combination state a series of relationships between formal (academic) and informal (play-time or therapy) activities with links between the two. In addition, the combination presents a wider range of teaching environments for the least developed children: hyperactive (from L), mentally-retarded care (from M), and general care (from L, M, and N).

The new interactions resulting from combination provided the following form implications:

- (12-21) New environments should offer activities, tasks, and objects similar to those found in a child's "familiar" environment. Participation in peer group activities may also encourage him to explore.
- (6-21) Boundaries between familiar and unfamiliar environments should be distinct.
- (29-82) Activity changes may prove more beneficial to the children if they are implemented by exercise.
- (51-89) (35-89) Any informal area should offer activities requiring varying degrees of skill. The aid of a supervisor should always be available in any informal activity.
- (12-29) Areas between activity locations should provide practice in navigation.
- (12-77) Mentally-retarded children should have repeated practice in navigation in familiar and unfamiliar environments; any practice in unfamiliar environments must be carefully controlled by a supervisor.
- (12-28) Children should experience environments in which there are loud or harsh noises.
- (14-23) A child's talking during individual study should not disturb others.
- (19-21) Teacher-therapists must be able to give instructions for group activities within informal areas and on trips into the community.
- (17-57) Activity areas for the non-hyperactive, in which concentration on sound is important, should be acoustically shielded from hyperactive therapy and informal areas.
- (6-8) A blind child should be easily able to find help in any new or complex activity or environment.
- (6-50) Activities beneficial for a handicapped child will include those which force his physical or mental exertion.

Although interactions were picked up in this combination, their form implications duplicated ones considered within the subsystems and are thus not included in this discussion.

The solution statements generated from the combination and new form implications are:

1. Informal activity areas should provide diverse activities and equipment, but each successive area should duplicate in part activities and equipment of lower stages. (This was discussed in part in subsystem L in which accessibility

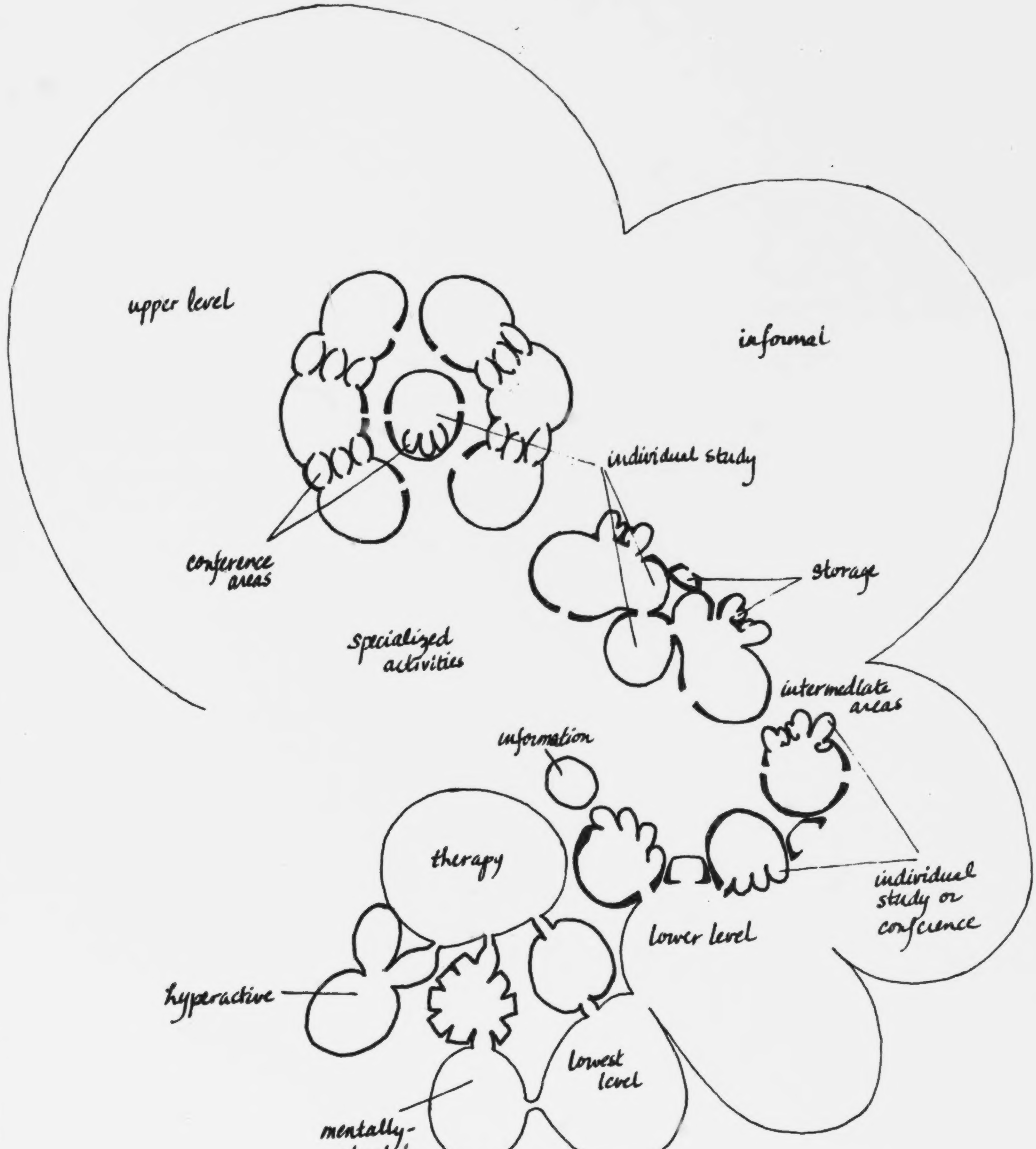
to several informal or physical exercise environments was desirable.)

2. Changes of locations for formal activities (when going from one formal activity area to another), should allow a child to pass through an informal activity area. (Informal activities can be in this case, a play area, a circulation path, informal mobility and orientation training, etc..)
3. Any informal activity area should be within audial and visual range of supervisors.
4. Children must be able to travel either by themselves or with a supervisor into the community. Ideally, this would consist of trips to a particular destination that supplement instruction (e.g., visits to cultural facilities, shopping centers, etc., with travel being on foot, not entirely by transportation facilities).
5. There should be places within any informal environment that are shielded from the noises of children's activities.
6. Hyperactive children may require separate facilities within group therapy areas since scheduling of times in which those facilities may be used will not tend to coincide with their needs for energy release.
7. Supervisors should always be available at any transition zone (for instance, a boundary that denotes an increase in complexity) particularly to aid children from a lower level.
8. There should be distinct boundaries between any two activities.

Form Solution: The general configuration for subsystems L, M, and N draws its external form notable from subsystem L while all three subsystems define the internal relationships. It encompasses children at various levels of competance (developmental levels). Formal activity areas at the lower levels relate directly to informal areas, at intermediate levels both to informal activities and to specialized activity areas, and at upper levels are related internally to other formal activity areas with access to informal and specialized activity areas. Three formal/informal areas act as relatively isolated units. These are for the least perceptually developed hyperactive, mentally-retarded and more "normal" children. Each has its own informal area, and each formal area related directly to therapy. In close proximity to therapy and to the lowest and lower levels is an information center for storage of children's records.

Informal activity areas retain a continuum as stated in L. Between formal areas in the lower and intermediate levels are natural "pockets" that will provide a place in which group instructions may be given.

The combination provides better definition to individual formal activity areas at all levels. The general form for the formal areas comes from subsystem N. Individual activity areas from M have been reinterpreted in light of the combination and are considered a part of the small adjoined areas in the previous N diagram. From L comes a strong relationship of storage for every formal activity area. In the combination diagram these places for storage occur between and around the consultation/individual activity areas. Other storage to which only a teacher-therapist or other supervisor has access, or over which he has control, are located near access points to formal areas. Storage areas also appear adjacent to formal areas but with access from informal areas. At the lowest levels, storage functions also as a barrier defining the formal areas and is located out of the children's reach since their perceptual development and their understanding of which objects are dangerous are minimal.


upper level
informal
individual study
conference areas
storage
specialized activities
intermediate areas
information
therapy
individual study or conference
lower level
hyperactive
lowest level
mentally-retarded

LMN

OPQ

Combination of Subsystems O, P, Q

This group of subsystems is primarily concerned with the relationships between the school and the parents of a blind child, between parents and their child, and between staff members and the child in the process of his diagnosis, therapy and continuing education. Policy considerations -- the way in which the school relates to individuals who operate primarily outside its bounds, including parents -- are identified at the subsystem level and will not be restated here.

New interactions appearing in the combination include the following:

- (51-64) Any activity in which a child may be under stress in an attempt to achieve (i.e., therapeutic situations) should not be accessible to casual visitors.
- (60-51) Calls for observation of a child in activities outside the context in which he was taught particular skills.
- (61-66) (61-68) Calls for child's contact with visitors away from areas in which they might disturb a formal activity. The contact may, however, occur within the school, since those individuals should be able to see children within their own settings.
- (64-66) Calls for children's limited contact with the sighted community until they learn to control "abnormal" behavior. This might also be satisfied by bringing sympathetic individuals into the school setting rather than exposing the children to a hostile community.

Although there were other interactions, they were considered to have been satisfied at the individual subsystem level.

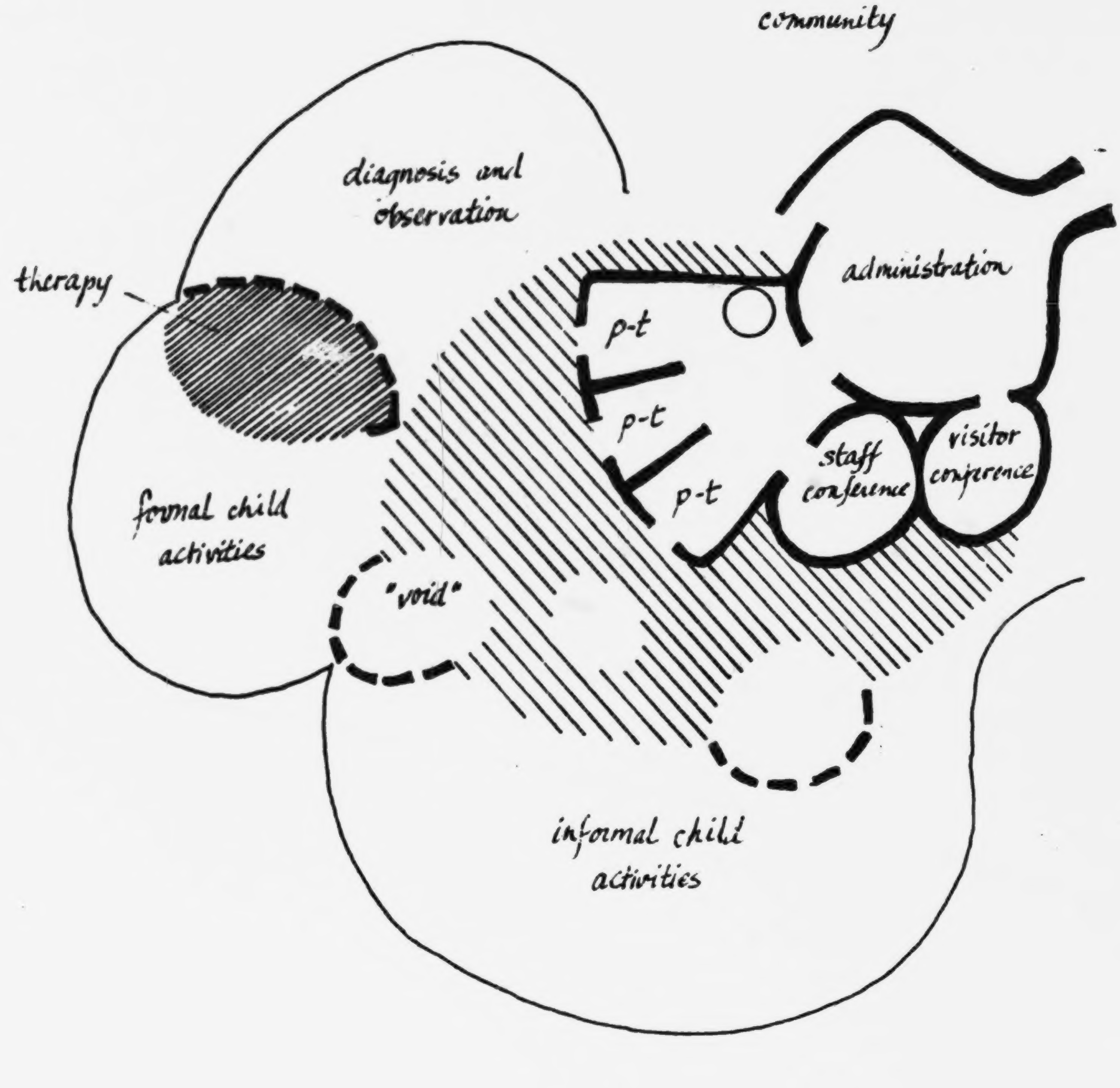
The new interactions generate the following solution statements.

1. Visitors should not have access to formal activities which must remain uninterrupted for the sake of continuity of instruction or those which would embarrass a child because of his handicaps. They may definitely have access, however, to an area in which an administrator might wish to meet with them.
2. A child should be able to retain ties with staff members with whom he has become close, whether or not they are officially responsible for him. Contact of this kind would necessarily be outside the classroom as well as within it, implying that normal activity areas for staff and children will overlap.

Form Solution:

The diagram shows a diagnostic-therapeutic-educational facility with its administrative complex drawn primarily from O, its internal configuration from Q and its internal relationships from P and Q. The administrative complex has two additional features: there is visual access between the parent-staff conference areas and the informal child activities area (from Q) and parent access to the child's informal or extracurricular activities area; there is another access point to the staff conference area through the general circulation (from P). The area designated "diagnosis and observation" combined those characteristics enumerated in subsystems P and Q. The area for therapy becomes jointly accessible to that area and to the formal child activities area (from P). The informal child activities area draws together both P and Q. "Voids" appear adjacent to both formal and informal child activities areas as well as within the circulation paths. Q acts on P in expanding the informal child activities area to reach out toward the community.

Because the administrator must be able to move within the system as an observer, staff members must be able to meet without interruptions or presence of either parents or children, and parents must be able to meet without their child knowing of their presence, the administrative complex functions as a unit linked with the customary child school environment through a buffer of circulation.


community
diagnosis and observation
therapy
administration
p-t
p-t
p-t
staff conference
visitor conference
formal child activities
"void"
informal child activities

OPQ

A-H

Combination of Subsystems A through H

Discussion

The combination of the three previously combined subsystems ABC, DEF, FGH, began with an investigation of conflicts and the thirty-four rejoined links. The primary conflict proved to be not so much the difference between any form considerations or requirements, but the mutually accepted concept of a set of intermediate levels. It was assumed, from the first moment of combination, that intermediate levels would exist in the combination. But when it proved that much critical information could not be included in the combination because of the very presence of this concept, it had to be omitted. A concept of primarily an intensive care and an upper level was adopted from ABC. The equivalent of defined intermediate levels was taken over by a concept of interaction between the two new levels that provided the blind child's developmental transition between the two.

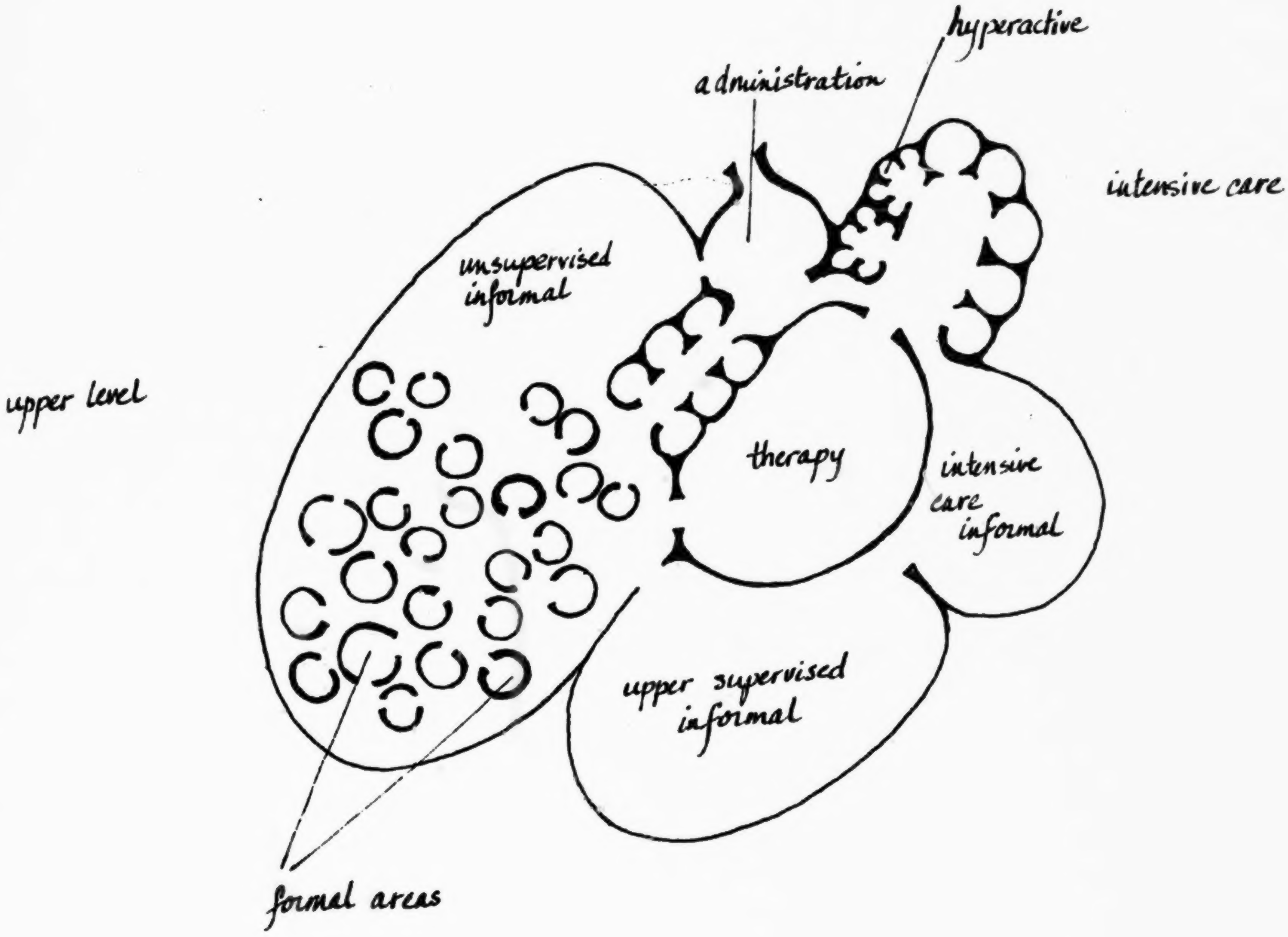
The rejoined links that had not been covered before, as it turned out, concerned information that did not lend itself to any new form considerations, such as describing to the blind child the nature of any activity which may, through length or complexity, confuse him.

From the three subsystems came the following concepts: A combined formal and informal situation within defined areas, (DEF and FGH). FGH also included that all blind children should have available to them a supervised informal area distinct from any defined formal or formal/informal unit. This supervised informal area would be available to all students, with an unsupervised informal area for those students who were developmentally advanced enough to use it. From all three subsystems came the provision that there be supervised interchange between various developmental levels of blind children, but from FGH arose the provision that this occur between two different developmental levels of the supervised area.

Interaction between the intensive care level and the upper level would be accomplished, according to FGH, with the intensive care blind child introduced into one or two upper level classes. These classes would be located near the intensive care area, with the transitions very short and supervised. At the conclusions of these classes the intensive care blind child would be returned to his original level. As the intensive care blind child developed further he would be included in more upper level classes, returning after each, until his program was made up completely or upper level classes. Further development from this would be accomplished with increasingly sophisticated transitions and complex classes, according to FGH. This concenpt, though not exactly shared by the other combined subsystems, concurred with information included in them. Combination ABC and FGH called for definite boundaries limiting the intensive care area with more loosely defined boundaries at the upper levels. Both included as well an exit point, with ABC locating it at the administration area where it controlled access of visitors and other people to the following areas, intensive care, upper level, and therapy. It also controlled the blind child's circulation in and out of the school. Therapy was located, from DEF, in such a way as to serve both the intensive care level and the upper level. ABC suggested that areas within the facility be limited in size to assist the child in his orientation, adding a stable circulation system between these areas to aid in transition. DEF and FGH specifically defined a hyperactive unit included within the intensive care area but different from an intensive care unit. DEF provided for supervised transitions and a definition of the teacher/therapy units at the hyperactive level. ABC and DEF outlined the teaching units, and provided for other units such as therapy and special activity units in the upper level.

Overall, there are two levels of form after this combination. ABC and FGH defined relationships between areas, while ABC and DEF defined the structure of class activity areas. Also, all three evolved the concept of varied experience and stimulation that a blind child needs to adjust to the sighted world -- specifically, this should not be provided by a changing physical environment, but rather through changing his exposure to this environment through scheduling of his activities, based on his development.

Final Form Solution: Starting with the intensive care area, there are, grouped around a circulation core, various hyperactive and intensive care units. The hyperactive units include, within them, an informal area, a smaller group formal area, and isolated, low stimulation individual isolation spaces. The intensive care units contain formal and informal areas. The circulation core contains informal activities such as mobility training along with normal supervision. This circulation core is free from upper level blind children and other unauthorized persons. The administration, in addition to containing office space and various other functional needs, connects the upper level to the intensive care level and acts as a check on the circulation between them. It also is the access point from the outside world to both of the levels and the therapy area. The therapy area contains physical therapy and psychotherapy as well as a small informal area for blind children who are in therapy. The supervised informal areas are connected at the extremes to either the upper level or the intensive care level, and are connected in the middle by a link which permits some student migration in a supervised manner to the other level. The upper level is less formally ordered than the lower level. Its circulation is not so much determined by its self-importance, but by the formal units it connects. In other words, the formal units are placed primarily with a relation to one another with circulation being the space remaining. Circulation is not intended to be explicitly complex, rather it is possible for the blind child to select, or be scheduled for, as complicated or simple a series of transitions as his is capable of making. At that part of the upper level that overlaps with the intensive care level, the circulation is defined as being simple with the formal areas ordered about it to ease the entry of the intensive care blind child into the system. At the other extreme of development, in the upper level, an exit to the outside, via administration, is provided. An unsupervised informal area is also available to those in the upper level who are sufficiently advanced in development.


hyperactive
administration
intensive care
unsupervised informal
upper level
therapy
intensive care informal
upper supervised informal
formal areas

A-H

F-Q

Combination of Subsystems F through Q

Discussion

In bringing together the four combined subsystems FGH, IJK, LMN, and OPQ, rather than an exhaustive examination of individual rejoined links, each combined subsystem was studied extensively to identify the potential sources of conflict. Instead of discovering major differences in form, the conflicts that arose - and were dismissed as not being relevant to the physical form - centered upon differences in opinion upon a child's development. The act of combining produced certain new concepts, among them the clustering of units for formal activity area grouping (see the discussion on the intermediate level). The following is a discussion of each general area considered and the subsequent form diagram.

Administrative Complex: The F-Q combination draws heavily upon the administrative complex from OPQ. IJK and LMN modify the relationships presented in the complex by stating a strong relationship between informal and formal conference areas for staff members (IJK) and the relationship between children's records and both therapy and lower level formal activity areas. The relationship between informal areas and contact with individuals and environments outside the school, stated in IJK and implicit in FGH and LMN, becomes clearer in combination with OPQ. Access to the community is defined by the perimeter of the complex and of an upper level, supervised informal area. The informal staff conference and administrative areas provide implicity control of its use both by children and by visitors, parents, etc. The same access point functions as the administrator's direct access to the school system.

Therapy, Diagnosis and Observation: Therapy, indicated in IJK, LMN, and OPQ maintains the latter's direct link to formal activity areas. IJK and LMN clarify the relationship considering developmental levels. The result indicates that there is direct access between therapy and the intensive-care formal grouping, there is relatively direct access from the intermediate level, and there is access varying in directness from the upper level. The latter two modifications do not present a conflict with the OPQ relationship since children at those levels would be capable of reaching the therapy area without the direction and supervision mandatory at the lower or intensive-care level. Therapy is, furthermore, divided into physical and psychotherapy (from IJK). Since there will be some differences in therapeutic treatment for the less and more developed children and because psychiatric evaluation would become necessary in thorough diagnostic procedures (see OPQ) psychotherapy creates both an identifiable area and a partial division between areas for physical therapy.

Diagnosis and observation remain linked to therapy as indicated in OPQ. An overlap in functions of staff members and use of facilities becomes necessary since assuming the availability of unlimited numbers of either resident or visiting diagnosticians is unrealistic and creating excessive duplication in equipment is economically unfeasible. The diagnosis and observation area remains in proximity to parent-staff conference areas, and it shares with therapy reasonable proximity to children's records.

Intensive Care: The intensive care area is a group of formal areas for hyperactive, mentally-retarded and other children who are at low stages of perceptual and mental development. Each area is linked directly with a highly supervised informal activity area (from IJK and LMN) and all but the hyperactive unit shares a common access to therapy. The latter has direct access from its own therapy area to the multi-use therapy area (from LMN). The formal activities areas form a cluster used equally to facilitate staff information exchange, to provide a place for limited activity, and to provide contact between children of different formal areas (from FGH, IJK, and LMN). The cluster affords an opportunity to observe children within a peer group setting when undergoing diagnotic procedures (from OPQ). Since the need for close contact between staff members and children is so high, and the need for supervision so great, the groups within any formal activity area are very limited in number (FGH, IJK, and LMN).

Intermediate Level: The intermediate level provides a transition between intensive care and upper levels as previously indicated in FGH, IJK and LMN. Its formal activity areas form a cluster, the center of which is the location for group activities which can be interrupted (called "semi-formal" in IJK), while the individual formal areas contain uninterruptable activities (those requiring attention to activity sounds, requiring specific locations for students, requiring special equipment, etc.). The internal area provides contact between children of similar levels of academic development and contact between their teacher-therapists (from IJK and OPQ). The central area gives access to the informal activity areas, initially to the intermediate, or if necessary, to the intensive-care or upper level informal areas (from IJK and LMN). It is also in close proximity to physical therapy and psychotherapy (from IJK, LMN and OPQ) and enables occasional use of facilities located within the upper level formal activity area (from LMN).

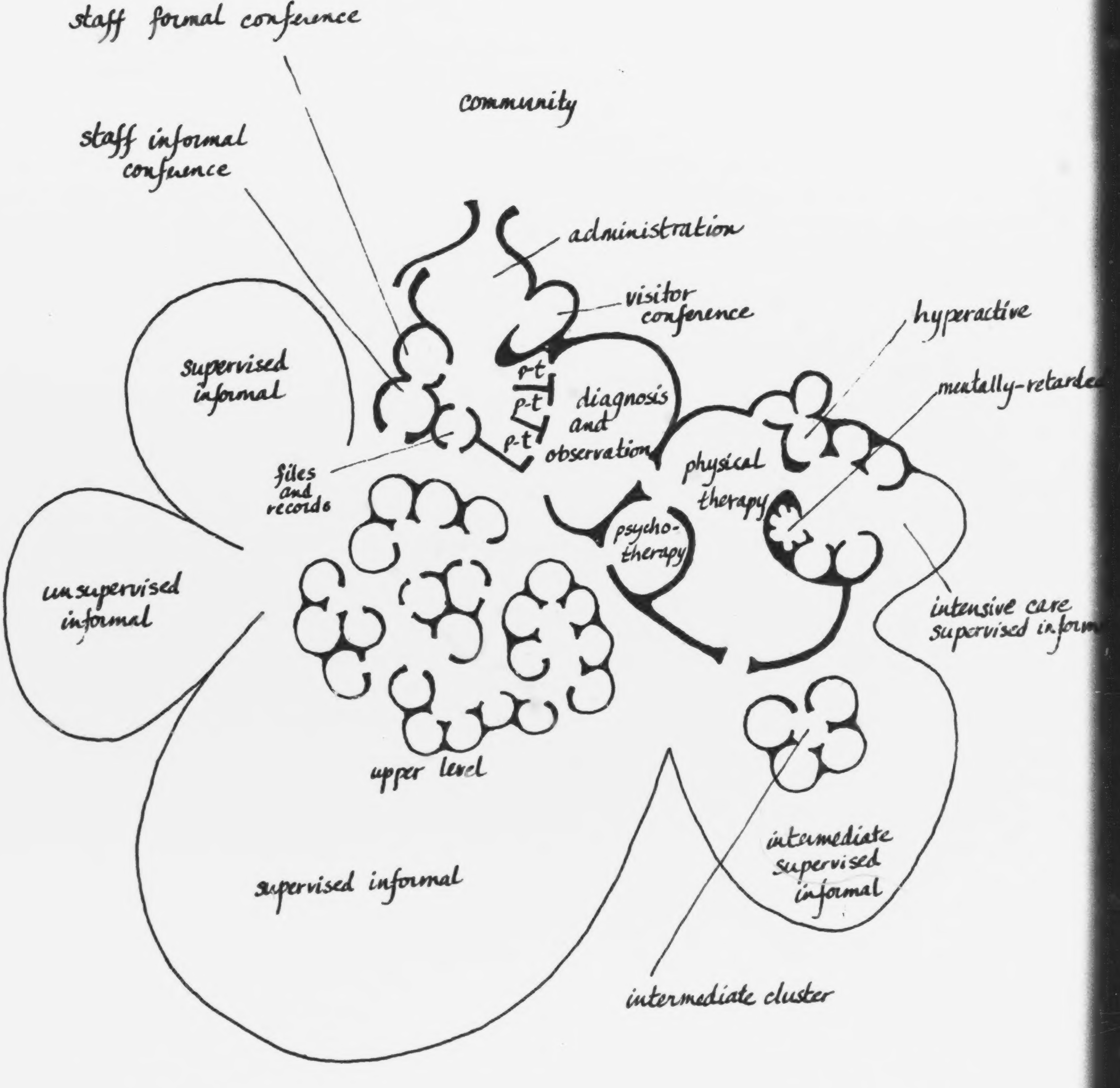
Upper Level: Each combination concerned with developmental levels (FGH, IJK and LMN) indicated a grouping of activity areas for children who had become relatively competent in academic work and perceptual abilities. The structure of the grouping is undefined in FGH, takes a linear form by peer groupings in IJK, and a closely linked cluster relating internally between formal areas and to individual study in LMN. In all cases the formal grouping relates to informal activity areas. FGH further defines this relationship by introducing an unsupervised informal activity area. Children have access to the community through a point leading from the formal activity area and adjacent to a supervised activity area and to the informal staff conference area. Access to the community was indicated in all combinations; supervision of access was implicit in FGH. Relating the informal staff conference area to the children's informal area implements the need for student-teacher contact, called for in OPQ.

The upper level has access to all areas within the school except the formal activity areas of the intensive care area. One of these necessary links is to physical therapy, but the link is one of relative proximity since children within this level are assumed to have intermittent, rather than frequent need for treatment. There is also access to psychotherapy, shared with children from the intermediate level.

The areas for formal activities within the upper level indicate both formal classroom areas (FGH, IJK and LMN) and areas for specialized activities -- those requiring special equipment or a specialized environment (from LMN). One of these areas, from LMN, is an individual study area. Since frequent changes in activities would occur at this level, the formal and special-use areas are located in relatively close proximity to each other (from IJK and LMN). Circulation between them can be, however, by paths varying in complexity (from FGH).

Informal Area: Each combination forming F-Q included areas designated for informal activities, in which there was a direct or an implicit relationship evident between formal and informal activity areas. In all but OPQ distinctions were made between areas for informal activities according to level of development. In combination, the structure for the informal areas comes from IJK and LMN in which there was a continuum. Beginning in intensive care in which activities are highly supervised and controlled, the informal areas become less supervised and structured through the intermediate and upper levels, until at the latter stage there is an unsupervised informal area (from FGH). At this level there is, in addition, a point of contact or access to the community, leading from a supervised informal area.

Each informal area was indicated to be progressively more complex in the nature of activities it accommodated (from IJK and LMN). However, contact between children of different developmental levels was desirable to stimulate a child's desire to progress (from FGH) and to make transitions between different developmental areas easier (from IJK and LMN). In order to achieve this, formal developmental areas are linked with more than one informal area. A modification of this appears in the intensive-care level in which access to the intermediate informal area is possible, but not easily achieved, unless the child has progressed enough to navigate the transition. The transition to the upper level is relatively easy at the intermediate level, and there is access to the intensive-care informal area for those children who are physically unable to cope with the intermediate activities or who require further contact with the lower level while adjusting to progression from intensive-care.


staff formal conference
community
staff informal conference
administration
visitor conference
hyperactive
mentally-retarde
supervised informal
p-t
p-t
p-t
diagnosis and observation
files and records
physical therapy
psychotherapy
unsupervised informal
intensive care supervised inform
upper level
supervised informal
intermediate supervised informal
intermediate cluster

F-Q

A-Q

Combination of Subsystems A through Q

Discussion

The final level of combination united two groups of combinations, each of which had developed a slightly different philosophy of the way in which subsystems and combinations should be worked. Due to differences inherent in the initial groups of requirements and differences in assumptions both in scale and in complexity pertaining to a child's development, the combination A-H placed strong emphasis upon movement internal to the school while the F-Q combination was oriented toward the way in which a child would develop within an educational system. These differences form the basis for effecting the final combination. The following discussion treats each general area or concept first, as the information each group brought to the final combination and second, as the resulting relationship.

Throughout the discussion, supervision appears as a necessary means to implement activities. Activities are referred to frequently as "supervised" or "unsupervised". For the purposes of this discussion, a supervised activity is one in which a staff member's participation in that activity is necessary either to initiate or control its action, or with which he maintains close contact. An unsupervised activity is one which a staff member may observe, but in which he does not necessarily participate except to give aid and assistance if desired by the children or if the activity involves any danger. Another form of supervision is implicitly generated by physical form (for instance, an access point at which there is a barrier provides control over a child's movement between areas whether or not a staff member is present).

Administration: In A-H an administrative complex functioned as a checkpoint between intensive-care and the remainder of the school and as a transition point between the school and the community. F-Q had similar, although more definite relationships to the community, first an access point for visitors to the school and secondly an access specifically for children and staff members. The administrative complex contained areas for the administrative staff, for conferences with visitors and with parents, for informal and formal conferences between staff members and for files and records on each child. The areas for parent-staff conferences were linked to a diagnostic and observationsal facility.

In combination, the basic form and specific relationships from F-Q are retained. There were two modifications, one in the child-staff access, to reflect the need for supervision of a child's movement to or from the school , and another in creating direct access between the administrative and intensive care areas. The constriction of this access, as indicated in the diagram, implies a highly controlled transition between the areas it connects.

Therapy: In A-H the area for therapy was shared between intensive care and upper level areas and was accessible to both. F-Q held the same relationships, but divided therapy by function into physical and psychotherapy. Therapy facilities were located closest to intensive care and intermediate areas since the children there would have the greatest need for them . It was also directly related to an information area containing each child's records. The facilities served in connection with diagnosis and observation for children who might enter or who were attending the school as well as for their parents.

The final combination in regard to therapy was relatively easy to effect since the relationships derived from each combination were similar. The F-Q interpretation served as the basis both for therapy and diagnosis and observation areas.

Informal Areas: The concept of areas for informal activities, relating strongly to formal areas, was present both in the A-H and the F-Q combinations. A-H considered informal activities in two ways: one requiring supervision and control and the second being unsupervised. The first kind existed in two parts, one relating directly to intensive care and the other relating to the upper level of the school. These two parts were linked through points of supervised access to provide contact between children of the different levels. There was also an area for unsupervised informal activity for the upper level children. Movement between formal areas was interpreted as another kind of informal activity.

Informal areas in the F-Q combination were similar in concept to A-H, but reflected the continuum of developmental levels. The informal area for intensive care was separate from the informal areas for the more advanced levels, except for allowing access to physically undeveloped or less secure children from the intermediate level. Since there was access to each informal area from more than one formal grouping, children of similar stages of physical development but different stages of mental development could mix, providing a means to effect an easier transition when a child progressed to the next developmental level. Each informal area was to be more complex than the one preceeding it, culminating in informal contact with the sighted.

In the final combination supervised informal activity areas relate directly to intensive care formal/informal areas. This supervised informal area adjoins a similar area for more developed children, and a supervised access point provides both cross-contact between the two areas and an access to the school. Less physically developed children from the intermediate area can reach the intensive care informal areas through the latter point. For upper level children there is an unsupervised informal activity area which is an outgrowth of informal movement within the formal areas.

Intensive Care: The intensive care unit in A-H included formal/informal areas for hyperactive and intensive-care children. There were no links specified between the classroom areas, but there was a definite link between the intensive care area and both a supervised informal area and therapy. Any area not occupied by a classroom unit was considered to be circulation space for personnel and supervised children. In F-Q, intensive care was divided into three separate kinds of formal/informal units for hyperactive, mentally-retarded and other multiply-handicapped children. Each classroom (formal/informal) area was linked directly with a supervised informal or play area. The hyperactive unit was, in addition, directly related to therapy. The formal/informal areas were closely related to facilitate teacher-therapist contact as well as provide contact between children of the different areas. All areas were in close proximity to physical and psychotherapy and, by extension, to diagnosis and observation and to each child's records.

In combination, special formal/informal areas are retained for hyperactive (from A-H and F-Q) and mentally-retarded (from F-Q). The F-Q relationship is maintained between the intensive care area and therapy, with circulation defined by both A-H and F-Q. The F-Q relationship between classrooms and informal supervised activity areas makes more specific the similar relationship from A-H.

Intermediate Developmental Levels: There was a general intermediate level in A-H as a transition between intensive care and the upper level. From this area the children would gradually be exposed to the operations in the upper level by daily trips into it, while taking the majority of their activities within the intermediate area.

Due to considerations of developmental levels F-Q developed a concept of clustering formal areas about less formal areas. The cluster relationship provided contact between children of similar levels of development and between teacher-therapists as well. The central less formal areas provided access to two informal activity areas. The cluster was in proximity to therapy, and related to activities internal to the school.

In the final combination the intermediate level takes the general form of that presented in F-Q. In interaction with A-H, the cluster is divided internally to provide a single access to the intermediate informal area, and from there, to the intensive care or upper level areas for informal activities. The relationship with therapy is maintained through an access point shared with children from the upper level.

Upper Level: In the upper level of A-H were formal or classroom area and special activity areas (e.g., language lab or auditorium). All space remaining outside these areas was for circulation. Transitions between areas were to remain relatively fixed near the intermediate area, but all formal areas, including those near the intermediate were to have a number of access points to the circulation system to provide a choice of direction and orientation.

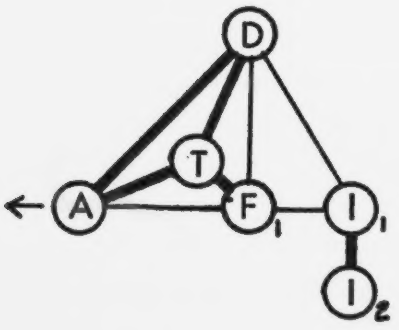
The combination F-Q considered only the final stage of development as an upper level for academic instruction or formal areas. Besides formal activities, it contained those activities in which special equipment or a special environment was necessary to conduct the activity. The formal areas related loosely to several informal areas, one of which led to the community. Since the ability to navigate successfully within the school complex was assumed to be characteristic of children within this area, there were assumed to be frequent changes of activity or class locations, according to the content of the activity; thus, formal or class areas were in close proximity to each other. Their relationships were, however, less defined than at the lower levels since come complexity in the environment was not only desirable, but necessary.

The final solution ordered to some extent the random concepts appearing both in A-H and F-Q. Reevaluation of the concepts of choice of path and complexity of environment took form. The area was related both to supervised and unsupervised activity areas. Specialized areas were dispersed, and contact with the community was more controlled, with access through the administrative complex.

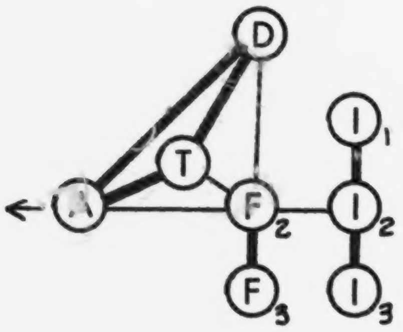
Circulation: The following diagrams are included to clarify the circulation system. The first three, smaller diagrams show ideal arrangements of areas according to developmental levels, and the fourth is a combination of the previous three. The links between any two areas can be of two types, primary and secondary. A primary link is a definite, direct link, but does not imply proximity. A secondary link need not lead directly to an area, but could be through another area or over two or more direct link circulation paths.

Ⓐ = Administration
Ⓓ = Diagnosis-Observation
Ⓣ = Therapy
Ⓕ = Formal (with informal in intensive care)
Ⓘ = Informal
○━○ = Primary link

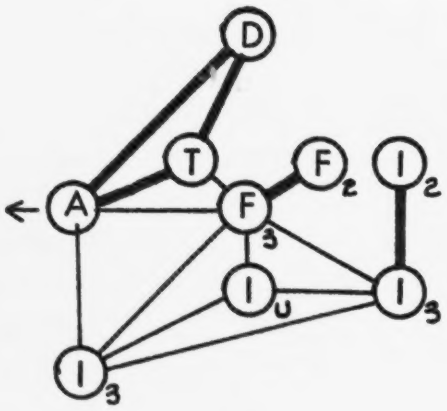
$\bigcirc_1$ = Intensive care
$\bigcirc_2$ = Intermediate level
$\bigcirc_3$ = Upper level
$\bigcirc_u$ = Unsupervised area
← = Link to outside
○─○ = Secondary link



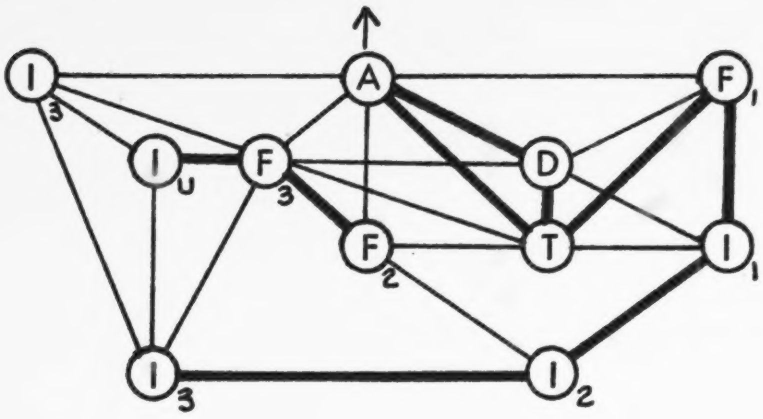
Intensive Care



Intermediate Level

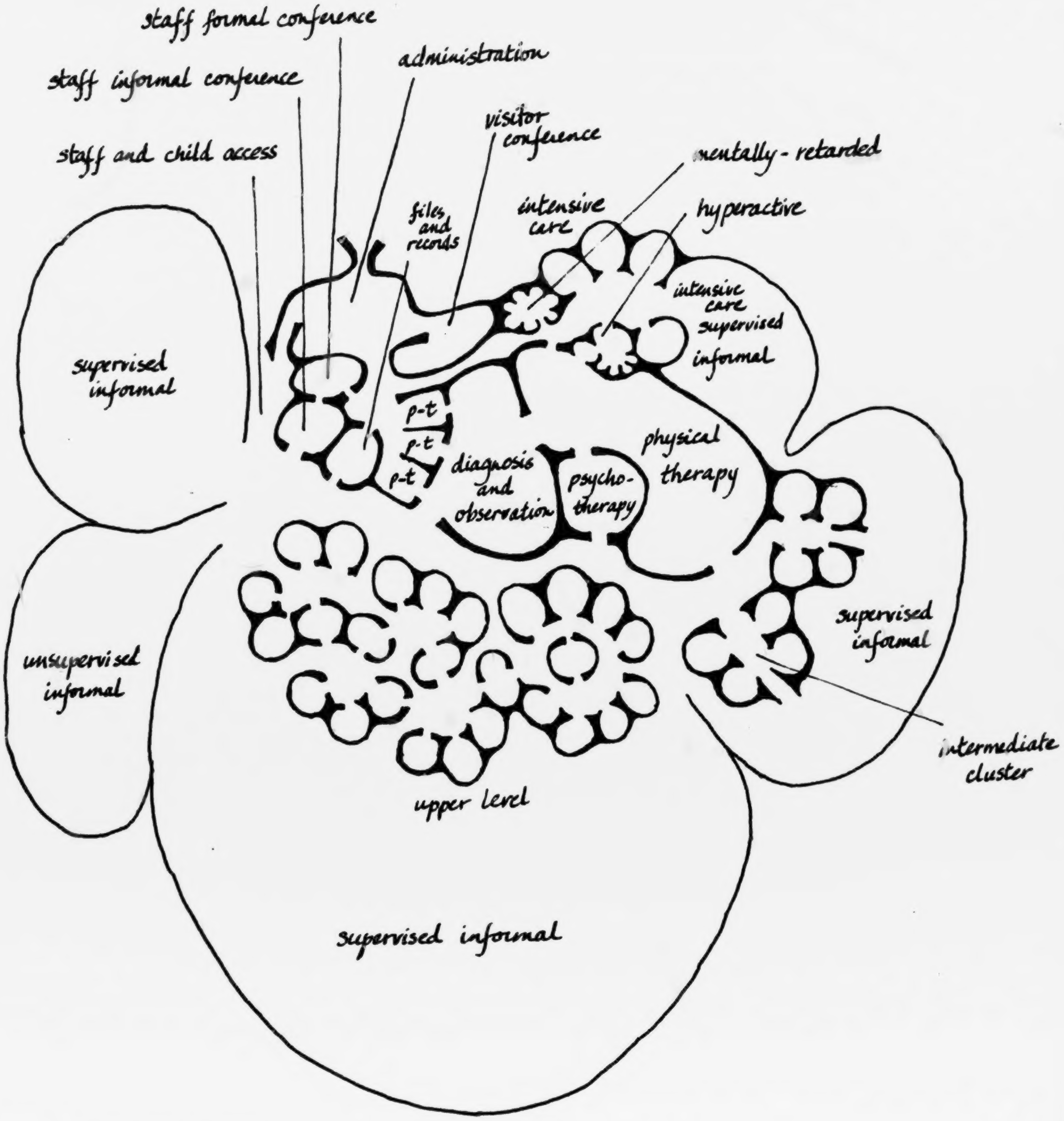


Upper Level



Combination

BIBLIOGRAPHY


staff formal conference
staff informal conference
administration
staff and child access
visitor conference
mentally-retarded
files and records
intensive care
hyperactive
intensive care supervised informal
supervised informal
p-t
p-t
p-t
physical therapy
diagnosis and observation
psycho-therapy
supervised informal
unsupervised informal
intermediate cluster
upper level
supervised informal

A-Q

BIBLIOGRAPHY

Allen, Frederick H., *Psychotherapy with Children*, 1942.

Alexander, Christopher, *Notes on the Synthesis of Form*, 1964.

Anonymous, *Services to Blind Children in N. Y. State*, 1959.

Axline, V. M., *Play Therapy*, 1947.

Bruner, Jerome S., *The Process of Education*, 1960.

Buell, B. S., *Physical Education for the Blind*, 1942.

Carroll, Thomas, *Blind Men*, 1960.

Chermayoff, Serge and Alexander, Christopher, *Community and Privacy*, 1963.

Cholden, Louis S., *A Psychiatrist Works with Blindness*, 1958

Cooke, Robert E., *The Special Child in Century 21*, 1954.

Cruickshank, William M., *Teaching Methodology for Brain Injured and Hyperactive Children*, 1960.

Cutsforth, Thomas D., *The Blind in School and Society*, 1951.

Dunsdon, M. I., *The Educability of Cerebral Palsied Children*, 1954.

Falk, A., *Adapted Physical Education*, 1947.

Frampton, Merle E., *Special Education for the Exceptional*, 1955.

Garry, Ralph and Ascarelli, Anna, *Experiment in Teaching Topographical Orientation and Spatial Organization to Congenitally Blind Children*, 1959.

Granit, Ragnar, *Receptors and Sensory Perception*, 1955.

Hawkins, V. T., *Educating the Brain Injured Child*, 1952

Hayes, R., *Contributions to a Psychology of Blindness*, 1941.

Hoch, Paul H. and Zubin, *Psychopathology of Perception*, 1965.

Huffman, Mildred, *Fun Comes First for Slow Learners*, 1957.

Hunt, Valerei V., *Recreation for the Handicapped*, 1955.

Lowenfeld, Bertold, *Our Blind Children*, 1956.

Mackie, Romaine P., *Crippled Children in American Education*, 1945.

Merry, R. V., *Problems in Education of Visually Handicapped Children*, 1933.

Moustakas, Clark E., *Children in Play Therapy*, 1953.

Mussen, Paul H., *The Psychological Development of the Child*, 1963.

Norris, Miriam and Spaulding, Patricia J., *Blindness in Children*, 1956.

Pearlstein, M. A., *What Teachers Should Know about Cerebral Palsy*, 1954.

Perkins, Fannie Lee, *Teaching Techniques for Cerebral Palsied Children*, 1963.

Piaget, Jean, *The Child's Conception of Geometry*, 1960.

Piaget, Jean, *The Origins of Intelligence in Children*, 1963.

Popper, Karl, *The Logic of Scientific Discovery*, 1965.

Saul, Leon J., *Bases of Human Behavior*, 1951.

Sommers, Vita (Stein), *The Influence of Parental Attitudes and Social Environment on the Personality Development of the Adolescent Blind*, 1944.

Stone, Elanor and Deyton, John, *Corrective Therapy for the Handicapped Child*, 1963.

U. S. Department of Health, Education and Welfare, *The Visually Handicapped Child*, 1951.

Vernon, M. D., *A Further Study of Visual Perception*, 1954.

Wright, B. A., *Physical Disability--A Psychological Approach*, 1960.

Zaul, Paul A., *Blindness*, 1962.

Zinger, Mendellsohn Q., *All There Is To Know about Blind Children*, 1966.